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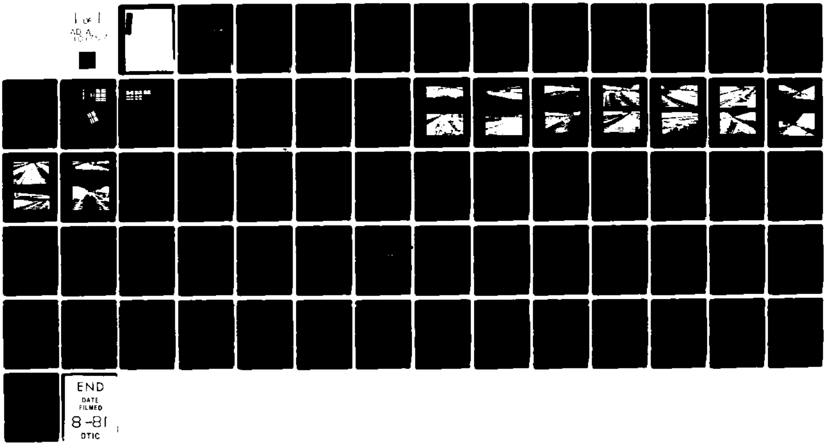

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MTMC REPORT TE 77-35

RAIL OUTLOADING CAPABILITY STUDY

DEFENSE GENERAL SUPPLY CENTER

RICHMOND, VIRGINIA

August 1978

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EXECUTIVE SUMMARY

1. SCOPE

The Military Traffic Management Command (MTMC) conducted a survey of the rail facilities of the Defense General Supply Center (DGSC), Richmond, Virginia, from 13 through 17 June 1977, to determine the condition of the trackage and the center's outloading capability.

2. FINDINGS

The primary finding is that, although rail outloading currently is a minor operation, sufficient capacity exists for major rail operations. The trackage currently being used is in generally good to fair condition. A lot of trackage is condemned and is in extremely poor condition, but this trackage is not vital to the rail operation. Of the trackage currently in use, deteriorated ties seem to be the biggest problem. The center has an ongoing rail maintenance program, and tie replacement is contracted for as funds are available. An entire spur is renovated at one time instead of spreading the repair work over the center.

The current operational capacity for an 8-hour day is 32 railcars. This is due to the one-railcrew limitation. If two railcrews were available, the capacity would be 64 railcars per day.

The mobilization capability is 194 railcars per day (24 hours), based on a 12-hour cycle. However, this number is somewhat limited by the fact that most of the rail traffic occurs at only two of the warehouses. An estimated 50-percent increase could be realized if the traffic were more uniformly spread among the different warehouses, or if the cargo in buildings with sparse rail traffic were consolidated so as to eliminate the pickup of only one car at a warehouse. The related switching sequence is shown in detail in the rail outloading simulation in appendix B.

The center is served by the Seaboard Coast Line (SCL) Railroad, which is a class 1 railroad. No problems are anticipated with this major railroad in case of a major outloading. The SCL should be able to supply needed cars and to readily pick up loaded trains, and to supply switch engines if needed.

3. CONCLUSIONS

a. Although all trackage currently being used at the center is in generally good to fair condition, and usable, some maintenance is required.

b. For mobilization, a rail capability of 194 railcars per day (24 hours) exists.

c. The rail traffic should be spread more evenly to different buildings for a more efficient switching operation and a higher outloading rate while using the same rail facilities, or some of the cargo should be consolidated in the buildings that have a low frequency of rail traffic. At present, over half of the rail traffic at the center occurs at only two of the warehouses.

d. For current outloading, when leadtime is plentiful and costs must be considered, special-purpose railcars (such as bilevel autoracks, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) cars) are more cost-effective than the standard types and should be used if available.

e. For mobilization moves, when time is more critical than cost, the use of special-purpose railcars may not be possible because of the short leadtime and relatively short supply of these high-demand cars.

f. Since the Seaboard Coast Line is a class 1 railroad, a major rail operation at the center should be handled concurrently with other local commercial demands without any difficulty.

g. A larger amount of the trackage could be upgraded by replacing only alternate defective ties instead of every one, as is now being done, during the annual maintenance program. This method would conform to the Federal Railway Administration's (FRA) definition of class 2 track, as defined in appendix A, since the maximum distance allowed between nondefective ties is 70 inches (center to center).

4. RECOMMENDATIONS

a. Prepare a detailed outloading plan, using the simulation in appendix B as an example, that specifies cargo assignments at loading sites and switching functions.

b. Coordinate mobilization activities with the Seaboard Coast Line, as early as practicable, for ordering 194 railcars per day and, if needed, for the use of switch engines.

c. Upgrade and maintain the classification yard and all existing track at locations (table 3) that presently have rail traffic to a minimum of class 2, as defined by FRA's track safety standards (app A).

d. Use special-purpose railcars (such as bilevel autotracks for small vehicles, TOFC for semitrailers and vans, and COFC for MILVANs) for administrative moves, and, as available, for mobilization moves.

e. Consolidate the cargo from the many storage locations now in use to allow a more even distribution of rail traffic among the different locations.

f. When replacing defective ties, instead of replacing each one, replace only every alternate one, which is acceptable in the track safety standards for class 2 track.

I. INTRODUCTION

In December 1976, the Defense General Supply Center (DGSC), figure 1, Richmond, Virginia, requested that MTMC conduct a rail facilities analysis. The principal objective of the study was to determine the ability of the rail facilities to transship supplies during a contingency situation. In June 1977, the Military Traffic Management Command Transportation Engineering Agency (MTMCTEA), Newport News, Virginia, conducted an onsite survey of rail trackage and warehouses. The major findings of the survey and the ensuing analyses were that most of the track presently used was in fair to good condition and that the rail receiving capability during a contingency was severely limited due to lack of contingency plans.

The center occupies a tract of 660 acres, 8 miles south of Richmond and 14 miles north of Petersburg on US Highways 1 and 301. The Seaboard Coast Line Railroad serves the center, with a main line on the western border and a branch line on the eastern border. Twenty-seven warehouses occupy more than 5 million gross square feet of covered storage space and are served by 26 miles of railroad track.

In 1976, the center shipped 91,349 tons of supplies and received 100,809 tons. Correspondingly, a monthly average of 615 trucks and 110 railcars were received while 785 trucks and 27 railcars were used to ship supplies. Trucking is presently the predominant mode of distribution at the center, with 63,721 tons per year received and 81,335 tons per year shipped, while rail receives 37,088 tons per year and ships 10,014 tons per year. This study will consider only rail facilities.

Throughout this report the following definitions are used to describe condition of trackage: good - requires no maintenance; fair - usable, but requires maintenance; poor - unusable, requires major maintenance.

Findings and recommendations contained in this report are based on analysis of data obtained during the field study and other pertinent information relating to installation activities at that time. Problems incurred during implementation of the recommendations should be referred to MTMCTEA for resolution.

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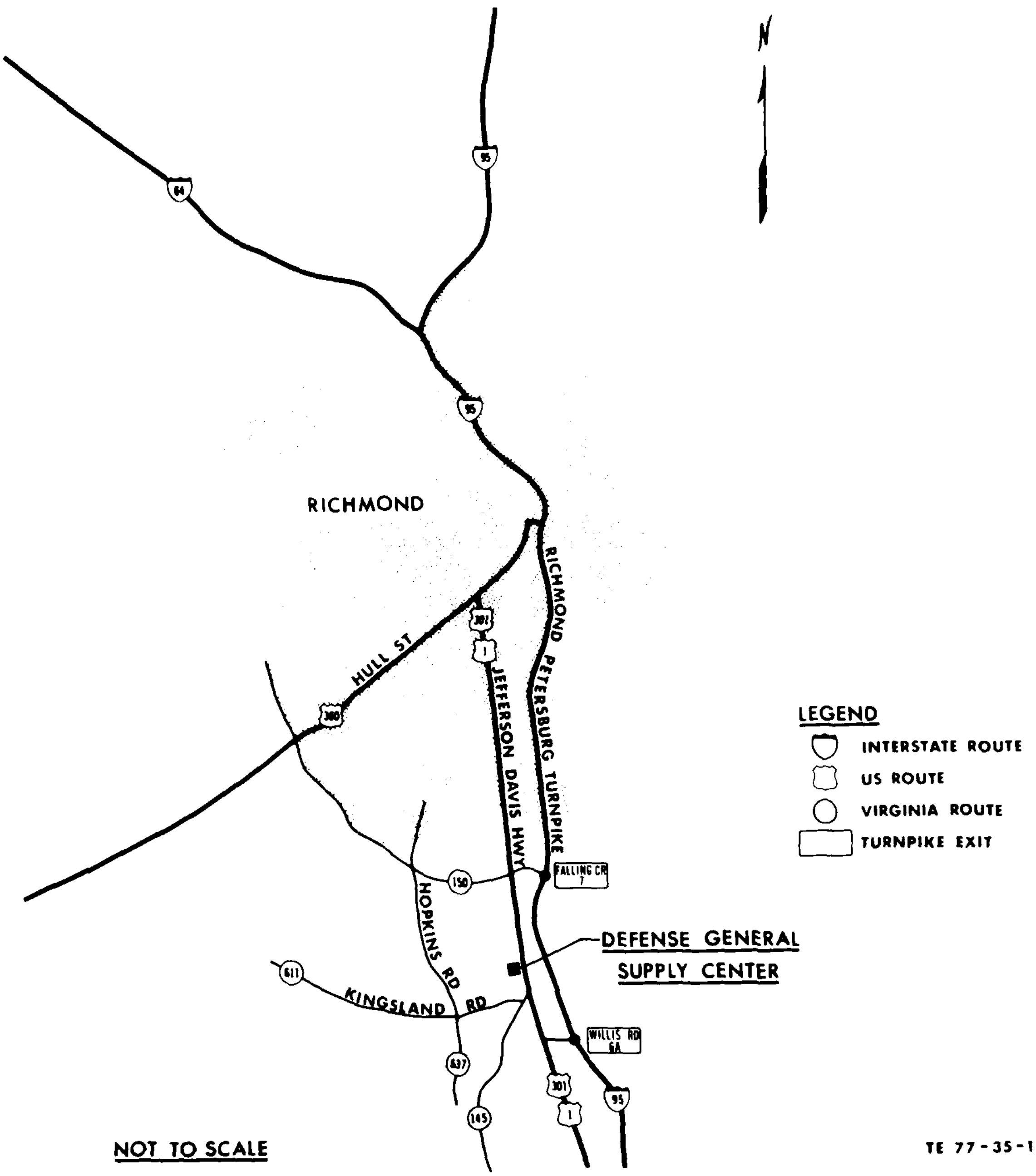


Figure 1. Defense General Supply Center and vicinity.

II. RAIL FACILITY DESCRIPTION

The DGSC rail system is illustrated in figure 2 and is described in table 1. From an overall viewpoint, the system has four distinct operational areas: the classification yard and the warehouses at the northern, southern, and eastern ends of the center. One leg of track, T-4 (fig 3), goes through to the northern end and feeds all the other tracks serving the warehouses in the northern sector. Tracks 20, T-10, and T-11 do not go through, but are blocked--track 20 by soil near warehouse 66 (WH-66) (fig 4) and tracks T-10 and T-11 by asphalt at WH 60 (fig 5). Tracks 32 (fig 6), 37 (fig 7), and 38 feed the tracks at the southern end, and tracks 39 (fig 8) and 42 (fig 9) feed the tracks at the eastern end. The classification yard is made up of tracks 1 through 14, shown in figures 10 and 11. Most of the track is in good condition with the exception of tracks 11, 12, and 13, as shown in figure 12, which are condemned. Track 7 has a bent section of rail. A few derailments have occurred along the ladder track (fig 13) on the west end of tracks 1 through 9. These switches need adjustment.

Presently, over half of the rail traffic at the center occurs at two buildings, WH-61 and WH-62 (fig 14), which are served by tracks T-5 and T-3, respectively. The condition of these tracks is fair.

WH-10 and WH-11, served by tracks 27 and 25 (fig 15), account for 3 percent each of the total rail traffic. The condition of these tracks is fair.

Each of the following places accounts for 2 percent of the rail traffic: OS-1, OS-2 (see fig 7), WH-7, WH-9 (fig 16), WH-12 (fig 17), WH-14, WH-15, and WH-66. These locations are served by tracks 38, 37, 28, 27, 25, 24, 22, and T-13 (fig 18), respectively. The condition of track 38 is good, and the condition of the others is fair.

Each of the following places accounts for 1 percent of the rail traffic: WH-3, WH-6, OS-39 (fig 19), OS-40 (see fig 3), OS-43, WH-63, WH-64, WH-77, WH-78, OS-75 (fig 20), WH-31 (see fig 9), WH-32 (see fig 8), and WH-33 (see fig 8). These locations are served by tracks 33, 30, T-3, T-5, T-10, T-3, T-5, T-5, T-3, T-10, 42,41, and 39, respectively. The condition of track 33 is good, and the condition of the others is fair.

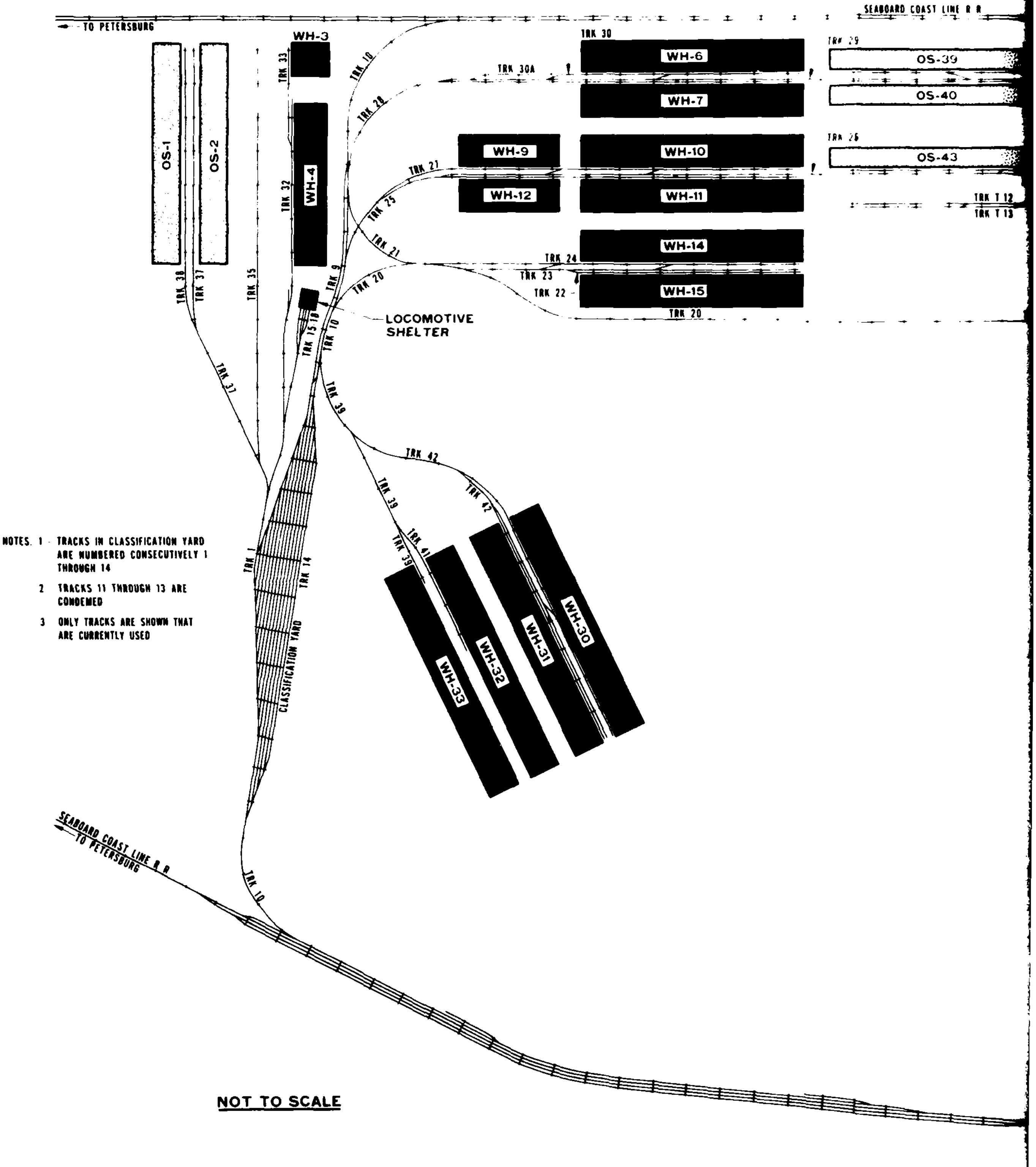
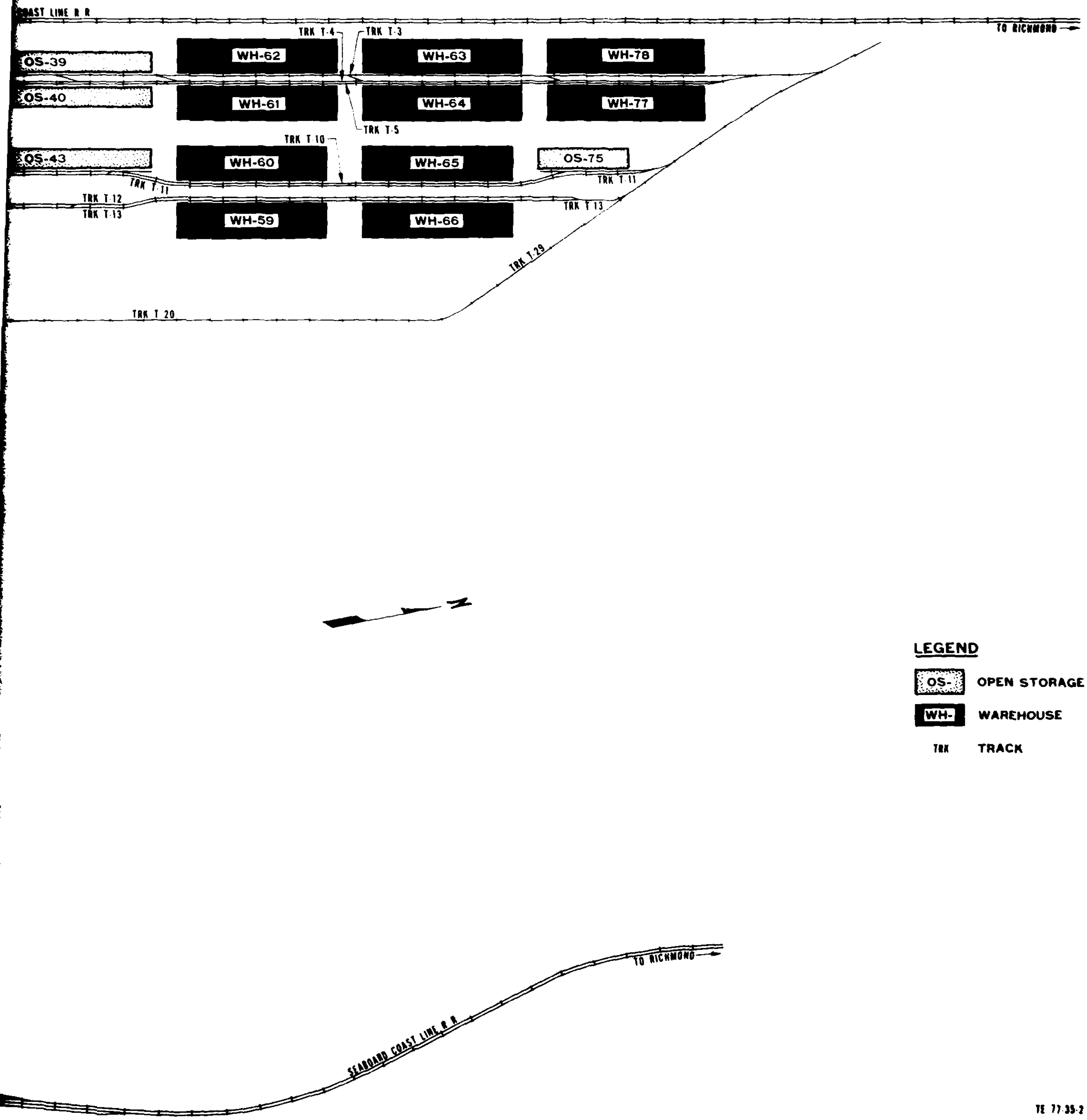


Figure 2. Defense General Supply Center site plan.


COAST LINE R R
TO RICHMOND
TRK T-4
TRK T-3
TRK T-5
TRK T-10
OS-39
OS-40
OS-43
OS-75
WH-62
WH-63
WH-78
WH-61
WH-64
WH-77
WH-60
WH-65
WH-59
WH-66
TRK T-11
TRK T-12
TRK T-13
TRK T-29
TRK T-20
N
LEGEND
OS- OPEN STORAGE
WH- WAREHOUSE
TRK TRACK
SEABOARD COAST LINE R R
TO RICHMOND

TE 77-35-2

2

TABLE 1
RAIL FACILITIES ON THE INSTALLATION

Track and Figure Number	Side Ramp	Lighting	Railcar Capacity (50-foot Lengths)	Area Served	Present Condition of Track	Comment
1 (figs 10, 11, and 13)	No	Yes	9	Classification yard	Good	Tracks 1 to 9 need switch repair on west end of classification yard.
2 (figs 10, 11, and 13)	No	Yes	12	Classification yard	Good	
3 (figs 10, 11, and 13)	No	Yes	15	Classification yard	Good	
4 (figs 10, 11, and 13)	No	Yes	18	Classification yard	Good	
5 (figs 10, 11, and 13)	No	Yes	22	Classification yard	Good	
6 (figs 10, 11, and 13)	No	Yes	25	Classification yard	Good	
7 (figs 10, 11, and 13)	No	Yes	29	Classification yard	Good	One section of the rail is bent.
8 (figs 10, 11, and 13)	No	Yes	32	Classification yard	Good	
9 (figs 10, 11, and 13)	No	Yes	35	Classification yard	Good	Portion of track 9 that runs to coal trestle is in poor condition.
10 (figs 10, 11, and 13)	No	Yes	51	Classification yard	Good	Track 10 is in poor condition between gate 16 and the Seaboard Coast Line on the west side of the center.
11 (figs 10, 11, and 13)	No	Yes	48	Classification yard	Poor	Condemned
12 (figs 10, 11, 12 and 13)	No	Yes	44	Classification yard	Poor[a],[b]	Needs ballast, condemned.
13 (figs 10, 11, and 13)	No	Yes	39	Classification yard	Poor[a],[b]	Condemned
14 (figs 10, 11, and 13)	No	Yes	38	Classification yard	Good[a]	Seldom used.
18	No	No		Locomotive shelter	Good	
19	No	No	2	N/A	Fair	Concrete end ramp.

a/ Rotten ties.
b/ Low ballast.

TABLE 1 - cont

Track and Figure Number	Side Ramp	Lighting	Railcar Capacity (50-foot Lengths)	Area Served	Present Condition of Track	Comment
20 (fig 4)	No	No	116	NA	Good[a]	Few rotten ties, good ballast, short piece on northern end covered with soil and rock.
21	No	No	NA	NA	Good	
22	Yes	Yes	27	WH-15	Fair[a]	
23	No	No	40	NA	Fair[a]	Track 23 feeds tracks 22 and 24.
24	Yes	Yes	44	WH-14	Fair[a]	
25 (figs 15 and 17)	Yes	Yes	42	WH-11 and 12	Fair	
26 (figs 15 and 17)	No	No	42	NA	Good	Track 26 feeds tracks 25 and 27.
27 (figs 15, 16, and 17)	Yes	Yes	47	WH-9 and 10	Fair[c]	Track covered with soil, weeded, and seldom used in front of WH-9.
28	Yes	Yes	43	WH-7	Fair	
29	No	No	43	NA	Good	Track 29 feeds tracks 28 and 30.
30	Yes	Yes	30	WH-6	Fair	
30A	No	No	10	NA	Poor	
32 (fig 6)	Yes	Yes	24	WH-4	Fair[a]	
33	Yes	Yes	12	WH-3	Poor[a]	Seldom used.
34	No	No	33	NA	Poor[a]	Not used, condemned.
35	No	No	48	NA	Fair[a],[d]	West end of track not used and covered with weeds and soil.
36	No	No	48	NA	Poor[a],[d]	Not used, condemned.

a/ See first page of table.
c/ Needs weed control.
d/ Missing spikes or tie plates.

TABLE 1 - cont

Track and Figure Number	Side Ramp	Lighting	Railcar Capacity (50-foot Lengths)	Area Served	Present Condition of Track	Comment
37 (fig 7)	No	Yes	32	OS-2	Fair[a],[c]	Concrete end ramp and concrete hardstand alongside track.
38	No	Yes	33	OS-1	Good[a]	Concrete hardstand alongside track, few rotten ties outside fence.
39 (fig 8)	Yes	Yes	20	WH-33	Fair[a]	
41	Yes	Yes	17	WH-32	Fair[a]	
42 (fig 9)	Yes	Yes	31	WH-31	Fair	
43	No	No	31	NA	Fair	Track 43 feeds tracks 42 and 44.
44	Yes	Yes	36	WH-30	Fair	Tracks on west end of building are paved over and not used.
T-1	No	No	91	NA	Poor	Feeds track T-2, not used, disconnected, condemned.
T-2	Yes	Yes	91	WH-62, 63, 78	Poor	Track disconnected at N. Second St., not used, condemned.
T-3 (figs 14 and 19)	Yes	Yes	108	WH-62,63,78	Fair	Needs ballast in front of WH-78.
T-4 (figs 3 and 19)	No	No	100	NA	Fair	Feeds tracks T-3 and T-5.
T-5 (fig 19)	Yes	Yes	98	WH-61, 64, 77	Fair	

[a] See first page of table.
[c] See second page of table.

TABLE 1 - cont

Track and Figure Number	Side Ramp	Lighting	Railcar Capacity (50-foot Lengths)	Area Served	Present Condition of Track	Comment
T-6	Yes	Yes	98	WH-64, 77	Poor[a/],[c/],[e/],	Not used, disconnected, condemned. Paved over in front of WH-61. Dirt blocks track at WH-77.
T-7	No	No	93	NA	Poor[a/],[c/],[e/]	Not used, disconnected, condemned. Paved over in front of WH-61. Dirt blocks track at WH-77.
T-8	No	No	48	NA	Poor[a/],[e/]	Not used, disconnected, condemned.
T-9	No	No	48	NA	Poor[a/],[c/],[e/]	Not used, disconnected, condemned.
T-10 (fig 5)	Yes	Yes	96	WH-60, 65	Fair to good	Condition poor, south of WH-60. Paved over behind part of WH-60.
T-11 (figs 5, 18, and 20)	No	No	100	NA	Fair to good	Condition poor at N. 2nd St.
T-12 (figs 5 and 18)	No	No	78	NA	Fair to good[a/]	Condition fair, south of WH-59. Dirt end ramp.
T-13 (fig 18)	Yes	Yes	83	WH-59, 66	Fair to good[c/]	Condition fair, south of WH-59. Dirt end ramp.
T-14	No	No	62	NA	Extremely poor[a/]	Blocked and paved over, not used, condemned.
T-15	No	No	65	NA	Extremely poor[a/]	Blocked and paved over, not used, condemned.

[a/]See first page of table.
[c/]See second page of table.
[e/]Contaminated ballast.

Figure 3. Track T-4 near warehouse 62, with track T-5 on the left, near OS-40 (looking south).

Figure 4. Track 20 blocked by soil near warehouse 66 (looking northwest).

Figure 5. Asphalt pad for trucks behind warehouse 60 (looking southeast).

Figure 6. Track 32 near locomotive shelter (looking west).

Figure 7. Track 37 near OS-2 (looking northeast).

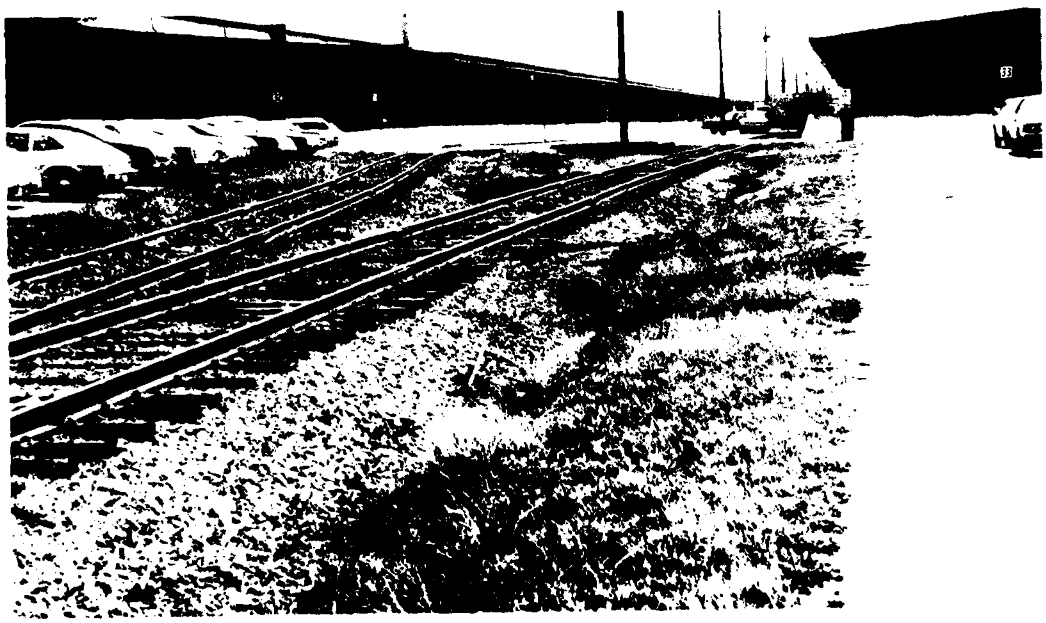


Figure 8. Track 39 near warehouse 33 (looking northeast).

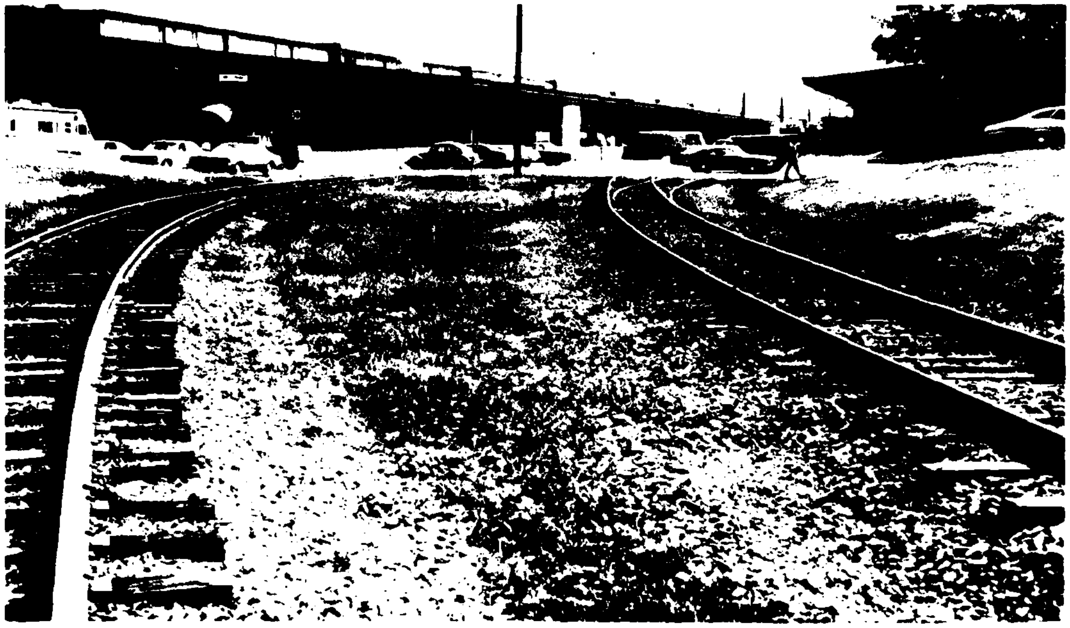


Figure 9. Track 42 near warehouse 31 (looking northeast).

Figure 10. Classification yard (looking west).

Figure 11. Classification yard (looking east).

Figure 12. Track 12 in classification yard (looking southwest).

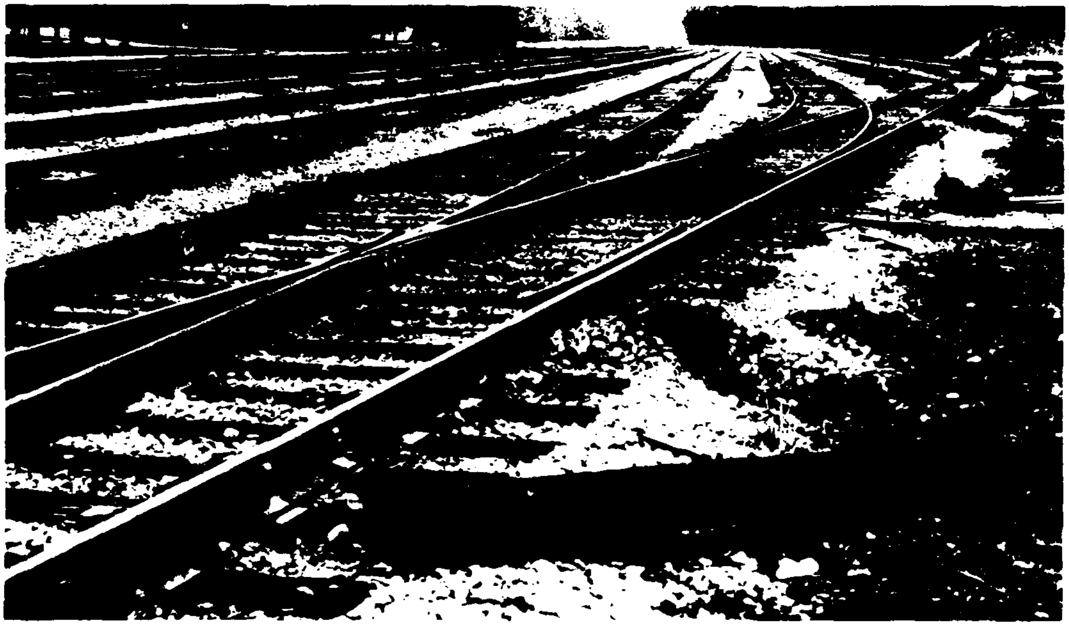


Figure 13. West end of classification yard (looking east).

Figure 14. WH-62 and track T-3 on the left, and WH-61 and track T-5 on the right (looking north).

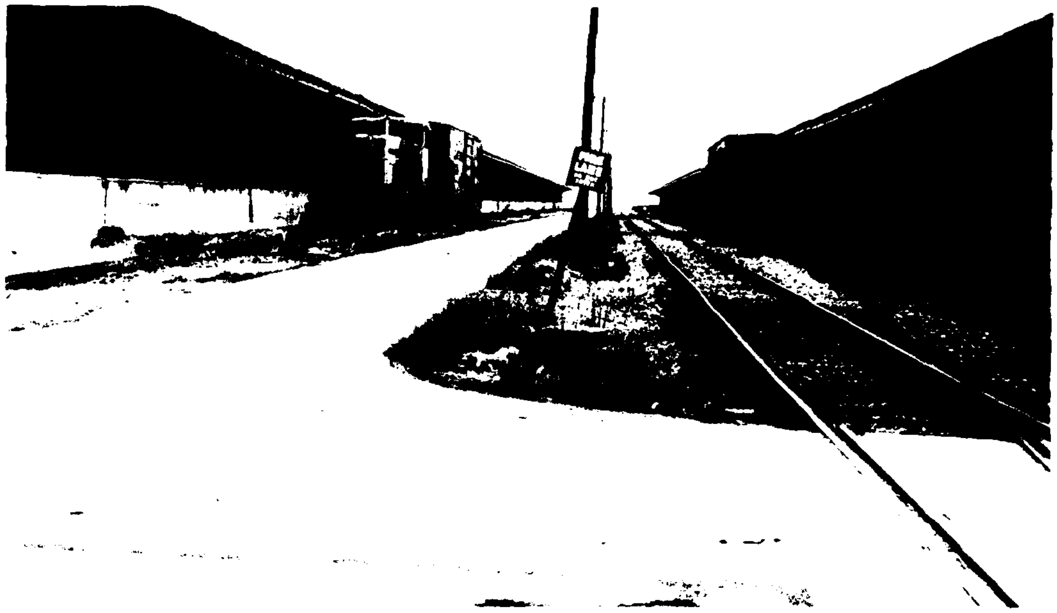


Figure 15. WH-10 and track 27 on the left, and WH-11 and track 25 on the right (looking north).

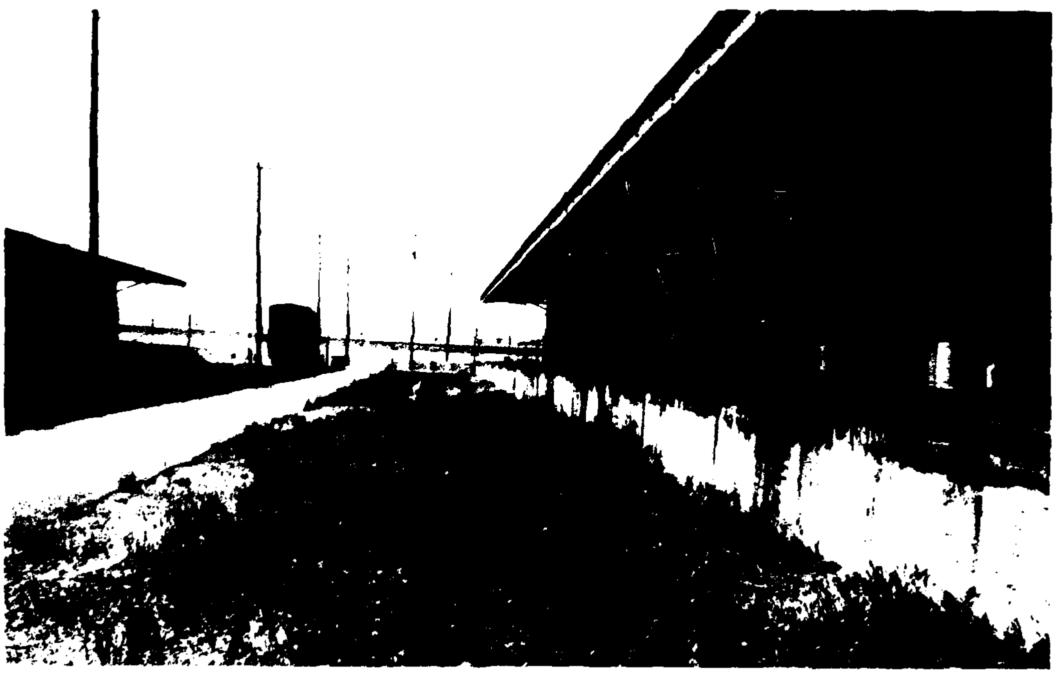


Figure 16. WH-9 and track 27 (looking south).

Figure 17. WH-12 and track 25 on the right (looking north).

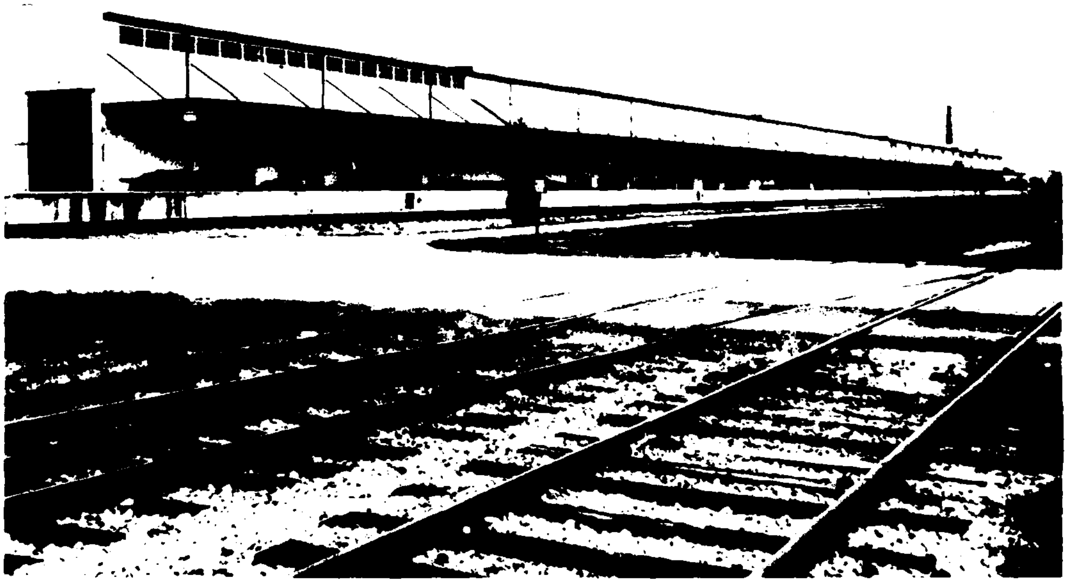


Figure 18. Track T-13 in foreground, which serves WH-66 (looking northwest).

Figure 19. OS-39 and track T-3 (looking south).

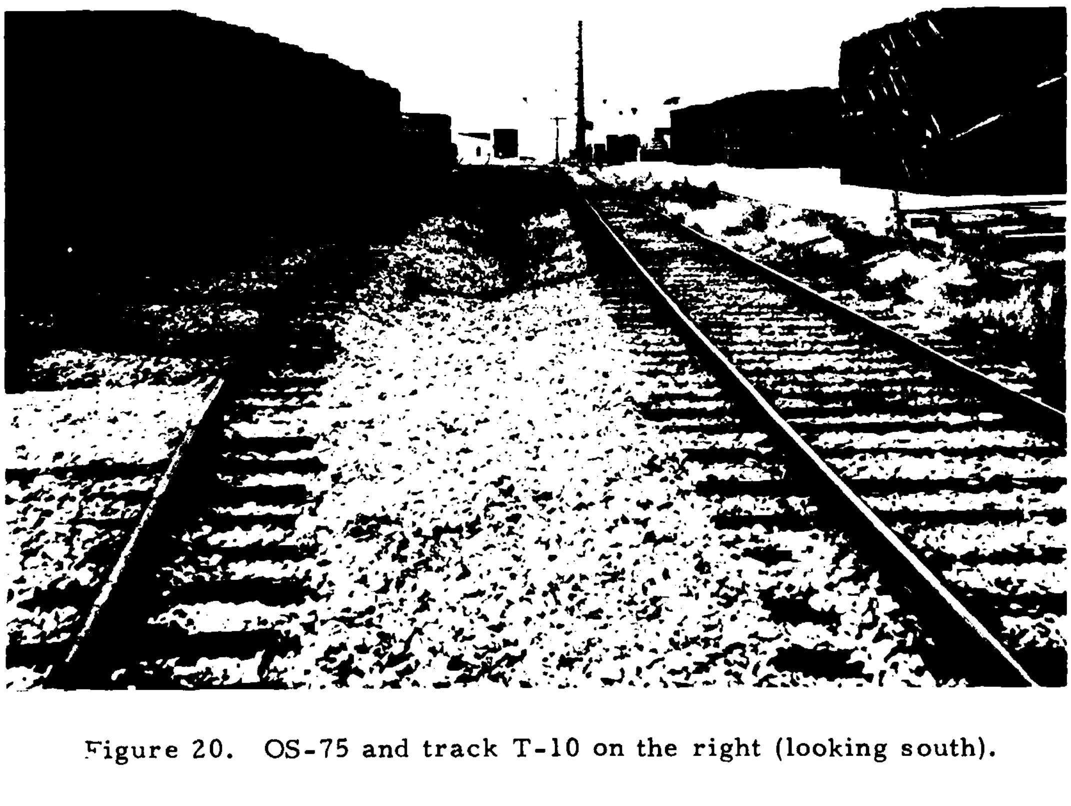


Figure 20. OS-75 and track T-10 on the right (looking south).

III. CURRENT PROCEDURES

Railcars are picked up from or delivered to a Seaboard Coast Line siding on the east side of DGSC by the center's rail crew. The center owns two 80-ton switch engines, one of which is in poor condition. The switching is normally done in a regular 8-hour workday. In 1976, the average number of railcars per workday received was 4.3, and the average number of railcars per workday shipped was 1.2. About 99 percent of the rail cargo is break-bulk cargo in boxcars.

IV. RAIL OUTLOADING ANALYSIS

A complex system structure can be viewed as a series of interconnected subsystems. The limiting subsystem within the system establishes the maximum outloading capability. Therefore, in ascertaining the maximum rail outloading capability at DGSC, the following subsystem separation was used.

A. COMMERCIAL SERVICE CAPABILITIES

Commercial service capabilities present no problem to the center. The common carrier serving the center is the Seaboard Coast Line Railroad, which is a class 1 railroad. The required boxcars should be obtainable during a mobilization.

B. LOADING, BLOCKING AND BRACING, AND SAFETY INSPECTIONS

The time required for loading various materials on different types of railcars varies widely. However, on the average, the figure is well known. Blocking and bracing and safety inspection times are difficult to project. They depend on a number of variables such as: (1) crew size and experience, (2) extent of the safety inspection, (3) documentation, and (4) availability of blocking and bracing materials and materials-handling equipment (MHE). Table 2 shows the average time required to load or unload a railcar for various types of cargo. Since almost all the cargo at the center is palletized, an average time of 4 hours was used for the outloading simulation, including times for blocking and bracing and inspections.

TABLE 2
LOADING/UNLOADING TIMES FOR RAILCARS

Cargo Type	Time in Hours
Drums	4
Loose cartons	8
Palletized or skidded	3

C. INTERCHANGE OF EMPTY AND LOADED RAILCARS

An efficient interchange of empty and loaded railcars requires careful planning and good coordination with the servicing railroad. Such an interchange can be established at the center because the Seaboard Coast Line has a main line adjacent to the west side of the center and a branch line, with sidings, on the east side of the center. Furthermore, the city of Richmond is nearby, containing the yards of both the Seaboard Coast Line and the Chesapeake and Ohio. The various plans for spotting railcars depend on the type of operation. A place or location must be provided for railcars (1) in empty storage, (2) in loaded storage, and (3) at the loading sites. In general, three balanced, or equally divided, areas must exist somewhere in the vicinity. If the loading sites double for the loaded storage area, the rail system can be considered to have two balanced areas. An equal number of spaces should be in the empty storage and in the loading sites. This would be the case also if the cars, after being loaded, were stored on the main line track that provides service to the installation. If the empty railcars can be stored at a nearby yard owned by the local railroad and can be delivered to the installation each day, as needed, then only one area on the installation is needed -- the loading sites. The advantage of a scheme with only one area on the installation is obvious; the outloading rate is much greater because all available trackage is used for loading. Thus, in addition to the permanent loading sites, temporary loading sites are set up wherever possible. However, the disadvantage of locating the empty storage, or possibly the loaded storage, off the installation is that extra care must be given to the planning to insure that the empty cars arrive at the loading sites on schedule.

For loading vehicles on flatcars, it is acceptable to place a temporary end-loading ramp on the tracks and drive the vehicles onto the flatcars. For loading containers onto a gondola, it is acceptable to temporarily place a crane beside a string of cars to lift the containers into place. However, it is not considered acceptable at the center to build temporary docks in order to load boxcars, using forklifts. Therefore, only the permanent loading docks were considered in this study. Thus, ample trackage exists to use the three balanced areas on the installation. The loading sites will be beside the warehouses and storage areas; the empty car storage and loaded car storage will be in the classification yard. If the interchange of railcars follows some semblance of the organization presented in the simulation (app B), the subsystem will not limit the capabilities of rail outloading operations at the center.

D. SUMMARY

Considering all the subsystems, the loading time for the railcars presently emerges as the primary constraint to any large-scale outloading operation at the center. Therefore, the rail system itself imposes no constraint on the capability to outload.

V. RAIL OUTLOADING PLAN

Since mobilization outloading plans were not available, a plan was developed to ascertain the maximum number of railcars per day that could be outloaded from DGSC. The assumption was made that the present distribution of rail traffic to the warehouses would be the same in the event of mobilization. That is to say, the most popular items now being stored will be the most popular items requested during mobilization. Of course, this assumption greatly complicates the railcar switching sequence. Instead of simply placing a railcar in front of every warehouse door and computing the time to load and switch the cars, the cars must be properly distributed among various warehouses. The present distribution of rail traffic is shown in table 3. Warehouses 61 and 62 account for the major

TABLE 3
PERCENTAGE OF TOTAL RAILCAR TRAFFIC
AT VARIOUS LOCATIONS

Location	Percentage*
OS-1	2
OS-2	2
OS-39	1
OS-40	1
OS-43	1
OS-75	1
WH-3	1
WH-6	1
WH-7	2
WH-9	2
WH-10	3
WH-11	3
WH-12	2
WH-14	2
WH-15	2
WH-31	1
WH-32	1
WH-33	1
WH-61	34
WH-62	32
WH-63	1
WH-64	1
WH-66	2
WH-77	1
WH-78	1

*Percentages total 101 due to rounding off numbers

portion of all rail traffic, about 66 percent. Either WH-61 or WH-62 accounts for at least 10 times the amount of traffic at any other location. This means that, during a major rail outloading, the activity will be at a torrid pace at WH-61 and WH-62 while it will go forward at almost a leisurely pace at other locations.

At first, an attempt was made to work out the simulation plan (app B) on an 8-hour cycle but it was not efficient. A 12-hour cycle resulted in a more efficient operation for this particular situation. Since each of the warehouses has 16 doors on 59-foot centers, only 16 boxcars at a time could be loaded at a particular warehouse.

This meant that, in order to apportion the rail traffic according to table 3, 16 cars would be placed at WH-61 and 15 cars at WH-62. Now, if these cars were picked up twice in a 12-hour cycle and all other locations in table 3 had the same number of cars as the integer listed in table 3, and were picked up only once in the same 12-hour cycle, then the rail traffic allocation would be almost perfectly satisfied (table 4). For example, one car would be placed at WH-3, two cars at WH-7, three cars at WH-10, and so forth.

TABLE 4
NUMBER OF RAILCARS SPOTTED AT EACH LOADING SITE
AT ANY GIVEN TIME

Location	Number of Railcars
OS-1	2
OS-2	2
OS-39	1
OS-40	1
OS-43	1
OS-75	1
WH-3	1
WH-6	1
WH-7	2
WH-9	2
WH-10	3
WH-11	3
WH-12	2
WH-14	2
WH-15	2
WH-31	1
WH-32	1
WH-33	1
WH-61*	16
WH-62*	15
WH-63	1
WH-64	1
WH-66	2
WH-77	1
WH-78	1

*WH-61 and WH-62 are loaded twice during each cycle and all other locations are loaded only once during each cycle.

VI. TRANSPORTATION EQUIPMENT COST - BILEVEL RAILCARS VERSUS 54-FOOT STANDARD FLATCARS

A cost comparison of nine different types of equipment to be *outloaded* in the REFORGER 77 exercise revealed that $129,431 in transportation and materials (timber, cable, and so forth) could be saved by shipping the equipment on bilevel railcars rather than on standard-type 54-foot flatcars. The equipment items vary from 1/4-ton trailers to 2-1/2-ton trucks. A total of 623 vehicles could be transported on 55 bilevel railcars (table 5 for details and app C for more information on special-purpose railcars).

TABLE 5

COST COMPARISON, BILEVELS VERSUS

Column Number	1	2	3	4	5	6	7
Item No.	Vehicle Type	Model Number	Weight (lbs)	Height (in.)	Length (in.)	Quantity to be Shipped	Quanity on 54- Railca
1	2-1/2-Ton Truck	M35A2	13,360	80.8	264.8	110	2
2	Gama Goat, 1-1/4-Ton	M561	7,480	71.9	231.1	27	2
3	M105A2 1-1/2-Ton Trailer	M105A2	2,670	82.0	166.0	113	3
4	1/4-Ton Trailer	M416	580	44.0	108.5	136	10
5	400-Gal Water Trailer	M149A1	2,530	80.6	161.4	20	4
6	1-1/4-Ton Truck	M880	4,695	73.5	218.5	11	2
7	3/4-Ton Trailer	M101	1,350	50.0	147.0	8	4
8	1/4-Ton Truck	M151	2,350	52.5	131.5	180	7
9	1-1/4-Ton Como Truck	M884	4,648	67.5	218.5	18	2
	Total					623	

SUMMARY

Total cost to ship the 9 different items (623 vehicles) by 54-foot-long standard flatcars, Column
Total cost to ship the 9 different items (623 vehicles) by 89-foot-long bilevel flatcars, Column 1
Savings in transportation costs if shipped by bilevel flats (Column 10-- Column 14)
Additional costs of blocking and bracing materials if shipped by 54-foot standard flatcars
Total savings if these nine items shipped by bilevel versus 54-foot flatcar

TABLE 5
.EVELS VERSUS 54-FOOT FLATCARS

	7	8	9	10 (8 x 9)	11	12	13	14 (12 x 13)
lty e ed	Quanity on 54-ft Railcar	Dollars	No. of 54-ft Cars Required	Trans Cost for Item	Quantity on 89-ft Bilevel	Dollars	No. of Bilevels Required	Trans Cost for Item
	2	2,413	55	132,715	6	7,238	18	130,284
	2	2,167	13	28,171	8	5,402	4	21,608
	3	2,167	37	80,179	12	3,612	9	32,508
	10	2,167	14	30,338	36	3,612	4	25,284
	4	2,167	5	10,835	12	3,612	2	7,224
	2	2,167	5	10,835	8	3,612	2	7,224
	4	2,167	2	4,334	12	3,612	1	3,612
	7	2,167	25	54,175	14	3,612	13	46,956
	2	2,167	9	19,503	8	3,612	2	4,334
				371,085			55	279,034

tcars, Column 10	$371,085	
tcars, Column 14	279,034	
)	$ 92,051	
latcars	37,380	($60 x 623)
	$129,431	

VII. SPECIAL EQUIPMENT FOR EXPEDITING THE OUTLOADING OF MILVANS

A large supply of trailer-on-flatcar railcars is usually in the system, and container-on-flatcar railcars may be available. These cars should be used to transport semitrailers and MILVANs. If COFC or TOFC flatcars are not available, some blocking and bracing time and expense can be saved by using bulkhead flatcars for transporting MILVANs. See appendix C for additional information.

VIII. CONCLUSIONS

1. All trackage currently being used at the center is in generally good to fair condition and usable; however, some maintenance is required.

2. For mobilization, a rail capability of 194 railcars per day (24 hours) exists.

3. The rail traffic should be spread more evenly to different buildings to make a more efficient switching operation wherein a higher outloading rate can be achieved with the same rail facilities; or some of the cargo should be consolidated in the buildings that have a low frequency of rail traffic. At present, over half of the rail traffic at the center occurs at only two of the warehouses.

4. For current outloading, when leadtime is plentiful and cost must be considered, special-purpose railcars (such as bilevel autoracks, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) cars) are more cost-effective than the standard types, and should be used if available.

5. For mobilization moves, when time is more critical than cost, the use of special-purpose railcars may not be possible because of the short leadtime and relatively short supply of these high-demand cars.

6. Since the Seaboard Coast Line is a class 1 railroad, a major rail operation at the center should be handled concurrently with other local commercial demands without any difficulty.

7. A larger amount of the trackage at the center could be upgraded by replacing only every alternate defective tie instead of every one, as is now being done during the annual maintenance program. This method would conform to the Federal Railway Administration's definition of class 2 track, as defined in appendix A, since the maximum distance allowed between nondefective ties is 70 inches (center to center).

IX. RECOMMENDATIONS

1. Prepare a detailed outloading plan, using the simulation in appendix B as an example, that specifies cargo assignments at loading sites and switching functions.

2. Coordinate mobilization activities with the Seaboard Coast Line, as early as practicable, for ordering of 194 railcars per day and, if needed, for the use of switch engines.

3. Upgrade and maintain the classification yard and all existing track at locations (see table 3) that presently have rail traffic to a minimum of class 2 as defined by FRA's track safety standards (app A).

4. Use special-purpose railcars (such as bilevel autoracks for small vehicles, TOFC for semitrailers and vans, and COFC for MILVANs), for administrative moves, and, as available, for mobilization moves.

5. Consolidate the cargo from the many storage locations now in use, to allow a more even distribution of rail traffic among the different locations.

6. When replacing defective ties, instead of replacing each one, replace only every alternate one, which is acceptable in the track safety standards for class 2 track.

APPENDIX A

TRACK SAFETY STANDARDS [1]

PART 213—TRACK SAFETY STANDARDS

Subpart A—General

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213.3 Application.
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213.9 Classes of track: operating speed limits.
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213.131 Planks used in shimming.
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213.139 Spring rail frogs.
213.141 Self-guarded frogs.
213.143 Frog guard rails and guard faces; gage.

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213.201 Scope.
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213.207 Switch heaters.

Subpart F—Inspection

213.231 Scope.
213.233 Track inspections.
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213.237 Inspection of rail.
213.239 Special inspections.
213.241 Inspection records.

APPENDIX A—MAXIMUM ALLOWABLE OPERATING SPEEDS FOR CURVED TRACK

AUTHORITY: The provisions of this Part 213 issued under sections 202 and 209, 84 Stat. 971, 975; 45 U.S.C. 431 and 438 and § 1.49(n) of the Regulations of the Office of the Secretary of Transportation; 49 CFR 1.49(n).

SOURCE: The provisions of this Part 213 appear at 36 F.R. 20336, Oct. 20, 1971, unless otherwise noted.

Subpart A—General

§ 213.1 Scope of part.

This part prescribes initial minimum safety requirements for railroad track

[1] Extracted from Title 49, Transportation, Parts 200 to 999, pp 8-19, Code of Federal Regulations, 1973.

that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track.

§ 213.3 Application.

(a) Except as provided in paragraphs (b) and (c) of this section, this part applies to all standard gage track in the general railroad system of transportation.

(b) This part does not apply to track—

(1) Located inside an installation which is not part of the general railroad system of transportation; or

(2) Used exclusively for rapid transit, commuter, or other short-haul passenger service in a metropolitan or suburban area.

(c) Until October 16, 1972, Subparts A, B, D (except § 213.109), E, and F of this part do not apply to track constructed or under construction before October 15, 1971. Until October 16, 1973, Subpart C and § 213.109 of Subpart D do not apply to track constructed or under construction before October 15, 1971.

§ 213.5 Responsibility of track owners.

(a) Any owner of track to which this part applies who knows or has notice that the track does not comply with the requirements of this part, shall—

(1) Bring the track into compliance; or

(2) Halt operations over that track.

(b) If an owner of track to which this part applies assigns responsibility for the track to another person (by lease or otherwise), any party to that assignment may petition the Federal Railroad Administrator to recognize the person to whom that responsibility is assigned for purposes of compliance with this part. Each petition must be in writing and include the following—

(1) The name and address of the track owner;

(2) The name and address of the person to whom responsibility is assigned (assignee);

(3) A statement of the exact relationship between the track owner and the assignee;

(4) A precise identification of the track;

(5) A statement as to the competence and ability of the assignee to carry out the duties of the track owner under this part; and

(6) A statement signed by the assignee acknowledging the assignment to him of responsibility for purposes of compliance with this part.

(c) If the Administrator is satisfied that the assignee is competent and able to carry out the duties and responsibilities of the track owner under this part, he may grant the petition subject to any conditions he deems necessary. If the Administrator grants a petition under this section, he shall so notify the owner and the assignee. After the Administrator grants a petition, he may hold the track owner or the assignee or both responsible for compliance with this part and subject to penalties under § 213.15.

§ 213.7 Designation of qualified persons to supervise certain renewals and inspect track.

(a) Each track owner to which this part applies shall designate qualified persons to supervise restorations and renewals of track under traffic conditions. Each person designated must have—

(1) At least—

(i) One year of supervisory experience in railroad track maintenance; or

(ii) A combination of supervisory experience in track maintenance and training from a course in track maintenance or from a college level educational program related to track maintenance;

(2) Demonstrated to the owner that he—

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in this part.

(b) Each track owner to which this part applies shall designate qualified persons to inspect track for defects. Each person designated must have—

(1) At least—

(i) One year of experience in railroad track inspection; or

(ii) A combination of experience in track inspection and training from a course in track inspection or from a college level educational program related to track inspection;

(2) Demonstrated to the owner that he—

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part, pending review by a qualified person designated under paragraph (a) of this section.

(c) With respect to designations under paragraphs (a) and (b) of this section, each track owner must maintain written records of—

(1) Each designation in effect;

(2) The basis for each designation, and

(3) Track inspections made by each designated qualified person as required by § 213.241.

These records must be kept available for inspection or copying by the Federal Railroad Administrator during regular business hours.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973]

§ 213.9 Classes of track: operating speed limits.

(a) Except as provided in paragraphs (b) and (c) of this section and §§ 213.57 (b), 213.59(a), 213.105, 213.113 (a) and (b), and 213.137 (b) and (c), the following maximum allowable operating speeds apply:

[In miles per hour]

Over track that meets all of the requirements prescribed in this part for—	The maximum allowable operating speed for freight trains is—	The maximum allowable operating speed for passenger trains is—
Class 1 track	10	15
Class 2 track	25	30
Class 3 track	40	60
Class 4 track	60	80
Class 5 track	80	90
Class 6 track	110	110

(b) If a segment of track does not meet all of the requirements for its intended class, it is reclassified to the next lowest class of track for which it does meet all of the requirements of this part. However, if it does not at least meet the requirements for class 1 track, no operations may be conducted over that segment except as provided in § 213.11.

(c) Maximum operating speed may not exceed 110 m.p.h. without prior approval of the Federal Railroad Administrator. Petitions for approval must be filed in the manner and contain the information required by § 211.11 of this chapter. Each petition must provide sufficient information concerning the performance characteristics of the track, signaling, grade crossing protection, trespasser control where appropriate, and equipment involved and also concerning maintenance and inspection practices and procedures to be followed, to establish that the proposed speed can be sustained in safety.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973; 38 FR 23405, Aug. 30, 1973]

§ 213.11 Restoration or renewal of track under traffic conditions.

If, during a period of restoration or renewal, track is under traffic conditions and does not meet all of the requirements prescribed in this part, the work and operations on the track must be under the continuous supervision of a person designated under § 213.7(a).

§ 213.13 Measuring track not under load.

When unloaded track is measured to determine compliance with requirements of this part, the amount of rail movement, if any, that occurs while the track is loaded must be added to the measurement of the unloaded track.

[38 FR 875, Jan. 5, 1973]

§ 213.15 Civil penalty.

(a) Any owner of track to which this part applies, or any person held by the Federal Railroad Administrator to be responsible under § 213.5(c), who violates any requirement prescribed in this part is subject to a civil penalty of at least $250 but not more than $2,500.

(b) For the purpose of this section, each day a violation persists shall be treated as a separate offense.

Exemptions.

(a) Any owner of track to which this part applies may petition the Federal Railroad Administrator for exemption from any or all requirements prescribed in this part.

(b) Each petition for exemption under this section must be filed in the manner and contain the information required by § 211.11 of this chapter.

(c) If the Administrator finds that an exemption is in the public interest and is consistent with railroad safety, he may grant the exemption subject to any conditions he deems necessary. Notice of each exemption granted is published in the FEDERAL REGISTER together with a statement of the reasons therefor.

Subpart B—Roadbed

§ 213.31 Scope.

This subpart prescribes minimum requirements for roadbed and areas immediately adjacent to roadbed.

§ 213.33 Drainage.

Each drainage or other water carrying facility under or immediately adjacent to the roadbed must be maintained and kept free of obstruction, to accommodate expected water flow for the area concerned.

§ 213.37 Vegetation.

Vegetation on railroad property which is on or immediately adjacent to roadbed must be controlled so that it does not—

(a) Become a fire hazard to track-carrying structures;

(b) Obstruct visibility of railroad signs and signals;

(c) Interfere with railroad employees performing normal trackside duties;

(d) Prevent proper functioning of signal and communication lines; or

(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Subpart C—Track Geometry

§ 213.51 Scope.

This subpart prescribes requirements for the gage, alinement, and surface of track, and the elevation of outer rails and speed limitations for curved track.

§ 213.53 Gage.

(a) Gage is measured between the heads of the rails at right angles to the rails in a plane five-eighths of an inch below the top of the rail head.

(b) Gage must be within the limits prescribed in the following table:

Class of track	The gage of tangent track must be—		The gage of curved track must be—	
	At least—	But not more than—	At least—	But not more than—
1	4′ 8″	4′ 9¾″	4′ 8″	4′ 9¾″
2 and 3	4′ 8″	4′ 9½″	4′ 8″	4′ 9¾″
4	4′ 8″	4′ 9¼″	4′ 8″	4′ 9½″
5	4′ 8″	4′ 9″	4′ 8″	4′ 9½″
6	4′ 8″	4′ 8¾″	4′ 8″	4′ 9″

§ 213.55 Alinement.

Alinement may not deviate from uniformity more than the amount prescribed in the following table:

Class of track	Tangent track	Curved track
	The deviation of the mid-offset from 62-foot line [1] may not be more than—	The deviation of the mid-ordinate from 62-foot chord [2] may not be more than—
1	5″	5″
2	3″	3″
3	1¾″	1¾″
4	1½″	1½″
5	¾″	⅝″
6	½″	⅜″

[1] The ends of the line must be at points on the gage side of the line rail, five eighths of an inch below the top of the railhead. Either rail may be used as the line rail, however, the same rail must be used for the full length of that tangential segment of track.

[2] The ends of the chord must be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.

§ 213.57 Curves; elevation and speed limitations.

(a) Except as provided in § 213.63, the outside rail of a curve may not be lower than the inside rail or have more than 6 inches of elevation.

(b) The maximum allowable operating speed for each curve is determined by the following formula:

$$V_{max} = \sqrt{\frac{E_a + 3}{0.0007d}}$$

where

V_{max} = Maximum allowable operating speed (miles per hour).

E_a = Actual elevation of the outside rail (inches).

d = Degree of curvature (degrees).

Appendix A is a table of maximum allowable operating speed computed in accordance with this formula for various elevations and degrees of curvature.

§ 213.59 Elevation of curved track; runoff.

(a) If a curve is elevated, the full elevation must be provided throughout the curve, unless physical conditions do not permit. If elevation runoff occurs in a curve, the actual minimum elevation must be used in computing the maximum allowable operating speed for that curve under § 213.57(b).

(b) Elevation runoff must be at a uniform rate, within the limits of track surface deviation prescribed in § 213.63, and it must extend at least the full length of the spirals. If physical conditions do not permit a spiral long enough to accommodate the minimum length of runoff, part of the runoff may be on tangent track.

§ 213.61 Curve data for Classes 4 through 6 track.

(a) Each owner of track to which this part applies shall maintain a record of each curve in its Classes 4 through 6 track. The record must contain the following information:

(1) Location;

(2) Degree of curvature;

(3) Designated elevation;

(4) Designated length of elevation runoff; and

(5) Maximum allowable operating speed.

[38 FR 875, Jan. 5, 1973]

§ 213.63 Track surface.

Each owner of the track to which this part applies shall maintain the surface of its track within the limits prescribed in the following table:

Track surface	Class of track					
	1	2	3	4	5	6
The runoff in any 31 feet of rail at the end of a raise may not be more than	3½″	3″	2″	1½″	1″	½″
The deviation from uniform profile on either rail at the midordinate of a 62-foot chord may not be more than	3″	2¾″	2¼″	2″	1¼″	½″
Deviation from designated elevation on spirals may not be more than	1¾″	1½″	1¼″	1″	¾″	½″
Variation in cross level on spirals in any 31 feet may not be more than	2″	1¾″	1¼″	1″	¾″	½″
Deviation from zero cross level at any point on tangent or from designated elevation on curves between spirals may not be more than	3″	2″	1¾″	1¼″	1″	½″
The difference in cross level between any two points less than 62 feet apart on tangents and curves between spirals may not be more than	3″	2″	1¾″	1¼″	1″	¾″

Subpart D—Track Structure

§ 213.101 Scope.

This subpart prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical condition of rails.

§ 213.103 Ballast; general.

Unless it is otherwise structurally supported, all track must be supported by material which will—

(a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;

(b) Restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling equipment and thermal stress exerted by the rails;

(c) Provide adequate drainage for the track; and

(d) Maintain proper track crosslevel, surface, and alinement.

§ 213.105 Ballast; disturbed track.

If track is disturbed, a person designated under § 213.7 shall examine the track to determine whether or not the ballast is sufficiently compacted to perform the functions described in § 213.103. If the person making the examination considers it to be necessary in the interest of safety, operating speed over the disturbed segment of track must be

reduced to a speed that he considers safe.

§ 213.109 Crossties.

(a) Crossties may be made of any material to which rails can be securely fastened. The material must be capable of holding the rails to gage within the limits prescribed in § 213.53(b) and distributing the load from the rails to the ballast section.

(b) A timber crosstie is considered to be defective when it is—

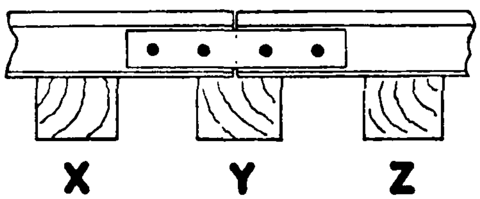
(1) Broken through;

(2) Split or otherwise impaired to the extent it will not hold spikes or will allow the ballast to work through;

(3) So deteriorated that the tie plate or base of rail can move laterally more than one-half inch relative to the crosstie;

(4) Cut by the tie plate through more than 40 percent of its thickness; or

SUPPORTED JOINT



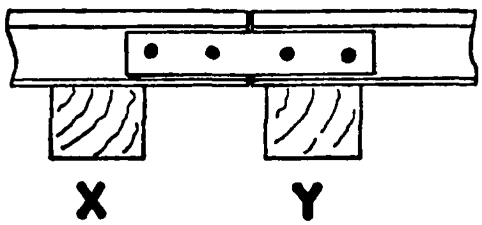
(5) Not spiked as required by § 213.127.

(c) If timber crossties are used, each 39 feet of track must be supported by nondefective ties as set forth in the following table:

Class of track	Minimum number of nondefective ties per 39 feet of track	Maximum distance between nondefective ties (center to center) (inches)
1	5	100
2, 3	8	70
4, 5	12	48
6	14	48

(d) If timber ties are used, the minimum number of nondefective ties under a rail joint and their relative positions under the joint are described in the following chart. The letters in the chart correspond to letters underneath the ties for each type of joint depicted.

SUSPENDED JOINT



Class of track	Minimum number of nondefective ties under a joint	Required position of nondefective ties: Supported joint	Required position of nondefective ties: Suspended joint
1	1	X, Y, or Z	X or Y.
2, 3	1	Y	X or Y.
4, 5, 6	2	X and Y, or Y and Z.	X and Y.

(e) Except in an emergency or for a temporary installation of not more than 6-months duration, crossties may not be interlaced to take the place of switch ties.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973]

§ 213.113 Defective rails.

(a) When an owner of track to which this part applies learns, through inspection or otherwise, that a rail in that track contains any of the defects listed in the following table, a person designated under § 213.7 shall determine whether or not the track may continue in use. If he determines that the track may continue in use, operation over the defective rail is not permitted until—

(1) The rail is replaced; or

(2) The remedial action prescribed in the table is initiated:

Remedial Action

Defect	Length of defect (inch)		Percent of railhead cross-sectional area weakened by defect		If defective rail is not replaced, take the remedial action prescribed in note—
	More than	But not more than	Less than	But not less than	
Transverse fissure			20		B.
			100	20	B.
				100	A.
Compound fissure			20		B.
			100	20	B.
				100	A.
Detail fracture			20		C.
Engine burn fracture			100	20	D.
Defective weld				100	A, or E and H.
Horizontal split head	0	2			H and F.
	2	4			I and G.
Vertical split head	4				B.
	(Break out in railhead)				A.
Split web Piped rail Head web separation	0	½			H and F.
	½	3			I and G.
	3				B.
	(Break out in railhead)				A.
Bolt hole crack	0	½			H and F.
	½	1½			I and G.
	1½				B.
	(Break cut in railhead)				A.
Broken base	0	6			E and I.
	6				(Replace rail).
Ordinary break					A or E.
Damaged rail					C.

Note:

A Assign person designated under § 213.7 to visually supervise each operation over defective rail.
B—Limit operating speed to 10 m.p.h. over defective rail.
C—Apply joint bars bolted only through the outermost holes to defect within 20 days after it is determined to continue the track in use. In the case of classes 3 through 6 track, limit operating speed over defective rail to 30 m.p.h. until angle bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
D Apply joint bars bolted only through the outermost holes to defect within 10 days after it is determined to continue the track in use. Limit operating speed over defective rail to 10 m.p.h. until angle bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
E—Apply joint bars to defect and bolt in accordance with § 213.121 (d) and (e).
F—Inspect rail 90 days after it is determined to continue the track in use.
G—Inspect rail 30 days after it is determined to continue the track in use.
H—Limit operating speed over defective rail to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
I—Limit operating speed over defective rail to 30 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.

(b) If a rail in classes 3 through 6 track or class 2 track on which passenger trains operate evidences any of the conditions listed in the following table, the remedial action prescribed in the table must be taken:

Condition	Remedial action	
	If a person designated under § 213.7 determines that condition requires rail to be replaced	If a person designated under § 213.7 determines that condition does not require rail to be replaced
Shelly spots Head checks Engine burn (but not fracture). Mill defect	Limit speed to 20 m.p.h. and schedule the rail for replacement.	Inspect the rail for internal defects at intervals of not more than every 12 months.
Flaking Slivered Corrugated Corroded	....do	Inspect the rail at intervals of not more than every 6 months.

(c) As used in this section—

(1) "Transverse Fissure" means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.

(2) "Compound Fissure" means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.

(3) "Horizontal Split Head" means a horizontal progressive defect originating inside of the rail head, usually one-quarter inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.

(4) "Vertical Split Head" means a vertical split through or near the middle of the head, and extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.

(5) "Split Web" means a lengthwise crack along the side of the web and extending into or through it.

(6) "Piped Rail" means a vertical split in a rail, usually in the web, due to failure of the sides of the shrinkage cavity in the ingot to unite in rolling.

(7) "Broken Base" means any break in the base of a rail.

(8) "Detail Fracture" means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.

(9) "Engine Burn Fracture" means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissure with which they should not be confused or classified.

(10) "Ordinary Break" means a partial or complete break in which there is no sign of a fissure, and in which none of the other defects described in this paragraph are found.

(11) "Damaged rail" means any rail broken or injured by wrecks, broken, flat, or unbalanced wheels, slipping, or similar causes.

(12) "Shelly spots" means a condition where a thin (usually three-eighths inch in depth or less) shell-like piece of surface metal becomes separated from the parent metal in the railhead, generally at the gage corner. It may be evidenced by a black spot appearing on the railhead over the zone of separation or a piece of metal breaking out completely, leaving a shallow cavity in the railhead. In the case of a small shell there may be no surface evidence, the existence of the shell being apparent only after the rail is broken or sectioned.

(13) "Head checks" mean hair fine cracks which appear in the gage corner of the rail head, at any angle with the length of the rail. When not readil: visible the presence of the checks may often be detected by the raspy feeling of their sharp edges.

(14) "Flaking" means small shallow flakes of surface metal generally not more than one-quarter inch in length or width break out of the gage corner of the railhead.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973; 38 FR 1508, Jan. 15, 1973]

§ 213.115 Rail end mismatch.

Any mismatch of rails at joints may not be more than that prescribed by the following table:

Class of track	Any mismatch of rails at joints may not be more than the following—	
	On the trend of the rail ends (inch)	On the gage side of the rail ends (inch)
1	¼	¼
2	¼	3/16
3	3/16	3/16
4, 5	⅛	⅛
6	⅛	⅛

§ 213.117 Rail end batter.

(a) Rail end batter is the depth of depression at one-half inch from the rail end. It is measured by placing an 18-inch straightedge on the tread on the rail end, without bridging the joint, and measuring the distance between the bottom of the straightedge and the top of the rail at one-half inch from the rail end.

(b) Rail end batter may not be more than that prescribed by the following table:

Class of track	*Rail end batter may not be more than—(inch)*
1	½
2	⅜
3	⅜
4	¼
5	⅛
6	⅛

§ 213.119 Continuous welded rail.

(a) When continuous welded rail is being installed, it must be installed at, or adjusted for, a rail temperature range

that should not result in compressive or tensile forces that will produce lateral displacement of the track or pulling apart of rail ends or welds.

(b) After continuous welded rail has been installed it should not be disturbed at rail temperatures higher than its installation or adjusted installation temperature.

§ 213.121 Rail joints.

(a) Each rail joint, insulated joint, and compromise joint must be of the proper design and dimensions for the rail on which it is applied.

(b) If a joint bar on classes 3 through 6 track is cracked, broken, or because of wear allows vertical movement of either rail when all bolts are tight, it must be replaced.

(c) If a joint bar is cracked or broken between the middle two bolt holes it must be replaced.

(d) In the case of conventional jointed track, each rail must be bolted with at least two bolts at each joint in classes 2 through 6 track, and with at least one bolt in class 1 track.

(e) In the case of continuous welded rail track, each rail must be bolted with at least two bolts at each joint.

(f) Each joint bar must be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends and to allow longitudinal movement of the rail in the joint to accommodate expansion and contraction due to temperature variations. When out-of-face, no-slip, joint-to-rail contact exists by design, the requirements of this paragraph do not apply. Those locations are considered to be continuous welded rail track and must meet all the requirements for continuous welded rail track prescribed in this part.

(g) No rail or angle bar having a torch cut or burned bolt hole may be used in classes 3 through 6 track.

§ 213.123 Tie plates.

(a) In classes 3 through 6 track where timber crossties are in use there must be tie plates under the running rails on at least eight of any 10 consecutive ties.

(b) Tie plates having shoulders must be placed so that no part of the shoulder is under the base of the rail.

§ 213.125 Rail anchoring.

Longitudinal rail movement must be effectively controlled. If rail anchors which bear on the sides of ties are used for this purpose, they must be on the same side of the tie on both rails.

§ 213.127 Track spikes.

(a) When conventional track is used with timber ties and cut track spikes, the rails must be spiked to the ties with at least one line-holding spike on the gage side and one line-holding spike on the field side. The total number of track spikes per rail per tie, including plate-holding spikes, must be at least the number prescribed in the following table:

MINIMUM NUMBER OF TRACK SPIKES PER RAIL PER TIE, INCLUDING PLATE-HOLDING SPIKES

Class of track	Tangent track and curved track with not more than 2° of curvature	Curved track with more than 2° but not more than 4° of curvature	Curved track with more than 4° but not more than 6° of curvature	Curved track with more than 6° of curvature
1	2	2	2	2
2	2	2	2	3
3	2	2	2	3
4	2	2	3	----------
5	2	3	----------	----------
6	2	----------	----------	----------

(b) A tie that does not meet the requirements of paragraph (a) of this section is considered to be defective for the purposes of § 213.109(b).

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.129 Track shims.

(a) If track does not meet the geometric standards in Subpart C of this part and working of ballast is not possible due to weather or other natural conditions, track shims may be installed to correct the deficiencies. If shims are used, they must be removed and the track resurfaced as soon as weather and other natural conditions permit.

(b) When shims are used they must be—

(1) At least the size of the tie plate;

(2) Inserted directly on top of the tie, beneath the rail and tie plate;

(3) Spiked directly to the tie with spikes which penetrate the tie at least 4 inches.

(c) When a rail is shimmed more than 1½ inches, it must be securely braced on at least every third tie for the full length of the shimming.

(d) When a rail is shimmed more than 2 inches a combination of shims and 2-

inch or 4-inch planks, as the case may be, must be used with the shims on top of the planks.

§ 213.131 Planks used in shimming.

(a) Planks used in shimming must be at least as wide as the tie plates, but in no case less than 5½ inches wide. Whenever possible they must extend the full length of the tie. If a plank is shorter than the tie, it must be at least 3 feet long and its outer end must be flush with the end of the tie.

(b) When planks are used in shimming on uneven ties, or if the two rails being shimmed heave unevenly, additional shims may be placed between the ties and planks under the rails to compensate for the unevenness.

(c) Planks must be nailed to the ties with at least four 8-inch wire spikes. Before spiking the rails or shim braces, planks must be bored with ⅝-inch holes.

§ 213.133 Turnouts and track crossings generally.

(a) In turnouts and track crossings, the fastenings must be intact and maintained so as to keep the components securely in place. Also, each switch, frog, and guard rail must be kept free of obstructions that may interfere with the passage of wheels.

(b) Classes 4 through 6 track must be equipped with rail anchors through and on each side of track crossings and turnouts, to restrain rail movement affecting the position of switch points and frogs.

(c) Each flangeway at turnouts and track crossings must be at least 1½ inches wide.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.135 Switches.

(a) Each stock rail must be securely seated in switch plates, but care must be used to avoid canting the rail by overtightening the rail braces.

(b) Each switch point must fit its stock rail properly, with the switch stand in either of its closed positions to allow wheels to pass the switch point. Lateral and vertical movement of a stock rail in the switch plates or of a switch plate on a tie must not adversely affect the fit of the switch point to the stock rail.

(c) Each switch must be maintained so that the outer edge of the wheel tread cannot contact the gage side of the stock rail.

(d) The heel of each switch rail must be secure and the bolts in each heel must be kept tight.

(e) Each switch stand and connecting rod must be securely fastened and operable without excessive lost motion.

(f) Each throw lever must be maintained so that it cannot be operated with the lock or keeper in place.

(g) Each switch position indicator must be clearly visible at all times.

(h) Unusually chipped or worn switch points must be repaired or replaced. Metal flow must be removed to insure proper closure.

§ 213.137 Frogs.

(a) The flangeway depth measured from a plane across the wheel-bearing area of a frog on class 1 track may not be less than 1⅜ inches, or less than 1½ inches on classes 2 through 6 track.

(b) If a frog point is chipped, broken, or worn more than five-eighths inch down and 6 inches back, operating speed over that frog may not be more than 10 miles per hour.

(c) If the tread portion of a frog casting is worn down more than three-eighths inch below the original contour, operating speed over that frog may not be more than 10 miles per hour.

§ 213.139 Spring rail frogs.

(a) The outer edge of a wheel tread may not contact the gage side of a spring wing rail.

(b) The toe of each wing rail must be solidly tamped and fully and tightly bolted.

(c) Each frog with a bolt hole defect or head-web separation must be replaced.

(d) Each spring must have a tension sufficient to hold the wing rail against the point rail.

(e) The clearance between the hold-down housing and the horn may not be more than one-fourth of an inch.

§ 213.141 Self-guarded frogs.

(a) The raised guard on a self-guarded frog may not be worn more than three-eighths of an inch.

(b) If repairs are made to a self-guarded frog without removing it from service, the guarding face must be restored before rebuilding the point.

§ 213.143 Frog guard rails and guard faces; gage.

The guard check and guard face gages in frogs must be within the limits prescribed in the following table:

Class of track	Guard check gage: The distance between the gage line of a frog to the guard line [1] of its guard rail or guarding face, measured across the track at right angles to the gage line, [2] may not be less than—	Guard face gage: The distance between guard lines, [1] measured across the track at right angles to the gage line, [2] may not be more than—
1	4′ 6⅛″	4′ 5¼″
2	4′ 6¼″	4′ 5⅛″
3, 4	4′ 6⅜″	4′ 5⅛″
5, 6	4′ 6½″	4′ 5″

[1] A line along that side of the flangeway which is nearer to the center of the track and at the same elevation as the gage line.
[2] A line ⅝ inch below the top of the center line of the head of the running rail, or corresponding location of the tread portion of the track structure.

Subpart E—Track Appliances and Track-Related Devices

§ 213.201 Scope.

This subpart prescribes minimum requirements for certain track appliances and track-related devices.

§ 213.205 Derails.

(a) Each derail must be clearly visible. When in a locked position a derail must be free of any lost motion which would allow it to be operated without removing the lock.

(b) When the lever of a remotely controlled derail is operated and latched it must actuate the derail.

§ 213.207 Switch heaters.

The operation of a switch heater must not interfere with the proper operation of the switch or otherwise jeopardize the safety of railroad equipment.

Subpart F—Inspection

§ 213.231 Scope.

This subpart prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part.

§ 213.233 Track inspections.

(a) All track must be inspected in accordance with the schedule prescribed in paragraph (c) of this section by a person designated under § 213.7.

(b) Each inspection must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. However, mechanical or electrical inspection devices approved by the Federal Railroad Administrator may be used to supplement visual inspection. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings, highway crossings, or switches.

(c) Each track inspection must be made in accordance with the following schedule:

Class of track	Type of track	Required frequency
1, 2, 3	Main track and sidings.	*Weekly* with at least 3 calendar days interval between inspections, or *before use*, if the track is used less than once a week, or *twice weekly* with at least 1 calendar day interval between inspections, if the track carries passenger trains or more than 10 million gross tons of traffic during the preceding calendar year.
1, 2, 3	Other than main track and sidings.	*Monthly* with at least 20 calendar days interval between inspections.
4, 5, 6		*Twice weekly* with at least 1 calendar day interval between inspections.

(d) If the person making the inspection finds a deviation from the requirements of this part, he shall immediately initiate remedial action.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.235 Switch and track crossing inspections.

(a) Except as provided in paragraph (b) of this section, each switch and track crossing must be inspected on foot at least monthly.

(b) In the case of track that is used less than once a month, each switch and track crossing must be inspected on foot before it is used.

§ 213.237 Inspection of rail.

(a) In addition to the track inspections required by § 213.233, at least once a

year a continuous search for internal defects must be made of all jointed and welded rails in Classes 4 through 6 track, and Class 3 track over which passenger trains operate. However, in the case of a new rail, if before installation or within 6 months thereafter it is inductively or ultrasonically inspected over its entire length and all defects are removed, the next continuous search for internal defects need not be made until 3 years after that inspection.

(b) Inspection equipment must be capable of detecting defects between joint bars, in the area enclosed by joint bars.

(c) Each defective rail must be marked with a highly visible marking on both sides of the web and base.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.239 Special inspections.

In the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, a special inspection must be made of the track involved as soon as possible after the occurrence.

§ 213.241 Inspection records.

(a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart.

(b) Each record of an inspection under §§ 213.233 and 213.235 shall be prepared on the day the inspection is made and signed by the person making the inspection. Records must specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection. The owner shall retain each record at its division headquarters for at least 1 year after the inspection covered by the record.

(c) Rail inspection records must specify the date of inspection, the location, and nature of any internal rail defects found, and the remedial action taken and the date thereof. The owner shall retain a rail inspection record for at least 2 years after the inspection and for 1 year after remedial action is taken.

(d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administrator.

APPENDIX A—MAXIMUM ALLOWABLE OPERATING SPEEDS FOR CURVED TRACK

Elevation of outer rail (inches)

Degree of Curvature	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
	Maximum allowable operating speed (mph)												
0°30′	93	100	107										
0°40′	80	87	93	98	103	109							
0°50′	72	78	83	88	93	97	101	106	110				
1°00′	66	71	76	80	85	89	93	96	100	104	107	110	
1°15′	59	63	68	72	76	79	83	86	89	93	96	99	101
1°30′	54	58	62	66	69	72	76	79	82	85	87	90	93
1°45′	50	54	57	61	64	67	70	73	76	78	81	83	86
2°00′	46	50	54	57	60	63	66	68	71	73	76	78	80
2°15′	44	47	50	54	56	59	62	64	67	69	71	74	76
2°30′	41	45	48	51	54	56	59	61	63	66	68	70	72
2°45′	40	43	46	48	51	54	56	58	60	62	65	66	68
3°00′	38	41	44	46	49	51	54	56	58	60	62	64	66
3°15′	36	39	42	45	47	49	51	54	56	57	59	61	63
3°30′	35	38	40	43	45	47	50	52	54	55	57	59	61
3°45′	34	37	39	41	44	46	48	50	52	54	55	57	59
4°00′	33	35	38	40	42	44	46	48	50	52	54	55	57
4°30′	31	33	36	38	40	42	44	45	47	49	50	52	54
5°00′	29	32	34	36	38	40	41	43	45	46	48	49	51
5°30′	28	30	32	34	36	38	40	41	43	44	46	47	48
6°00′	27	29	31	33	35	36	38	39	41	42	44	45	46
6°30′	26	28	30	31	33	35	36	38	39	41	42	43	45
7°00′	25	27	29	30	32	34	35	36	38	39	40	42	43
8°00′	23	25	27	28	30	31	33	34	35	37	38	39	40
9°00′	22	24	25	27	28	30	31	32	33	35	36	37	38
10°00′	21	22	24	25	27	28	29	31	32	33	34	35	36
11°00′	20	21	23	24	26	27	28	29	30	31	32	33	34
12°00′	19	20	22	23	24	26	27	28	29	30	31	32	3

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

APPENDIX B

PROPOSED RAIL OUTLOADING PROCEDURE DURING MOBILIZATION AT DGSC

General

Maximum rail outloading operations use a cyclic schedule to minimize conflicts and improve control. The rail outloading simulation is shown in figure 21. The simulation shows the switching sequence as a function of time.

The simulation begins with the assumption that it takes several days to accumulate the railcars necessary to start full-scale outloading operations. The switching locomotives position the arriving railcars at the designated loading sites, according to the simulation plan. The railcars are loaded and the cycle is ready to begin. Zero hour is defined as the beginning of the cycle.

Switching Locomotive #1

The first thing that switching locomotive #1 does is pick up the loaded cars at WH-61. This operation requires 31 minutes. This string of cars is taken to track 7 in the classification yard where it is dropped off, awaiting the pickup of the main line locomotives of the Seaboard Coast Line. The main line locomotives will have to come onto the installation to make up the train because the siding outside the gate is not long enough for the DGSC switching locomotives to deposit a whole train. Switching locomotive #1 now transits to track 6 and couples with 16 empty railcars. These cars are taken to WH-61 and dropped off one-by-one (spotted in front of a warehouse door). A total of 107 minutes has elapsed.

Now, loading begins at WH-61 and will continue for the next 4 hours. In the meantime, switching for consist #1 will be done. Consist #1 is made up of one car at WH-78, one car at WH-77, one car at WH-64, one car at WH-63, one car at OS-39, one car at OS-40, two cars at WH-7, and one car at WH-6. Consist #1 is dropped off at track 9. A total of 161 minutes has now elapsed.

The locomotive now transits to track 2 and couples with nine empty cars, then drops off empties at the following locations: one at WH-6, two at WH-7, and one each at OS-40, OS-39, WH-63, WH-64, WH-77, and WH-78. Now, the switching for consist #1 has been completed, and loading will begin, finishing 4 hours from the time that the empty car was spotted at WH-78. A total of 208 minutes has elapsed.

LEGEND	
C	COUPLE
UC	UNCOUPLE
TR	TRANSIT
L	LOADED CAR
E	EMPTY CAR
(15)	TIME EXPENDED FOR OPERATION (MIN)
TRK 7	TRACK LOCATION
16	NUMBER OF RAILCARS
SB	SET BRAKE
RB	RELEASE BRAKE
TRK	TRACK
WH	WAREHOUSE
OS	OPEN STORAGE

ELAPSED TIME (HOURS) 0

ELAPSED TIME (MINUTES) 0 10 20 30 40 50

SWITCHING LOCOMOTIVE #1				
	OPERATION	1	TR	UC-16-L SB
	TIME (MINUTES)		(10)	(15)
	TRACK LOCATION		TRK 7	TRK 7
	NO OF RAILCARS		16	0

SWITCHING FO

CONTINUATION OF LOADING FOR CONSIST #3

SWITCHING LOCOMOTIVE #2				
	OPERATION	79	TR	UC-15-L SB
	TIME (MINUTES)		(10)	(5)
	TRACK LOCATION		TRK 8	TRK 8
	NO OF RAILCARS		15	0

SWITCHING FO

CONTINUATION OF LOADING FOR C

NOTE FOOTNOTES ARE NOT TO SCALE

1

C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L	TR	C-1-L
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61	WH-61
1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10

47	48	49	50	51	52	53	54	55	56
TR	C-1-L RB	TR	C-1-L RB	TR	C-1-L RB	TR	C-1-L RB	TR	C-1-L RB
(1)	(1)	(3)	(1)	(1)	(1)	(2)	[illegible]	(1)	(1)
WH-10	WH-10	WH-12	WH-12	WH-12	WH-12	WH 9	WH 9	WH-9	WH-9
6	7	7	8	8	9	9	10	10	11

95	96	97	98	99	100	101	102	103	104
UC-1-E SB	TR	UC-1-E SB	TR	UC-1-E SB	UC-1-E SB	TR	UC-1-E SB	TR	UC-1-E SB
(1)	(2)	[illegible]	(1)	[illegible]	(1)	[illegible]	[illegible]	3	(1)
WH 15	WH-14	WH-14	WH 14	WH-14	WH 66	WH 66	WH 66	OS 75	OS 75
5	5	4	4	3	2	2	[illegible]	[illegible]	0

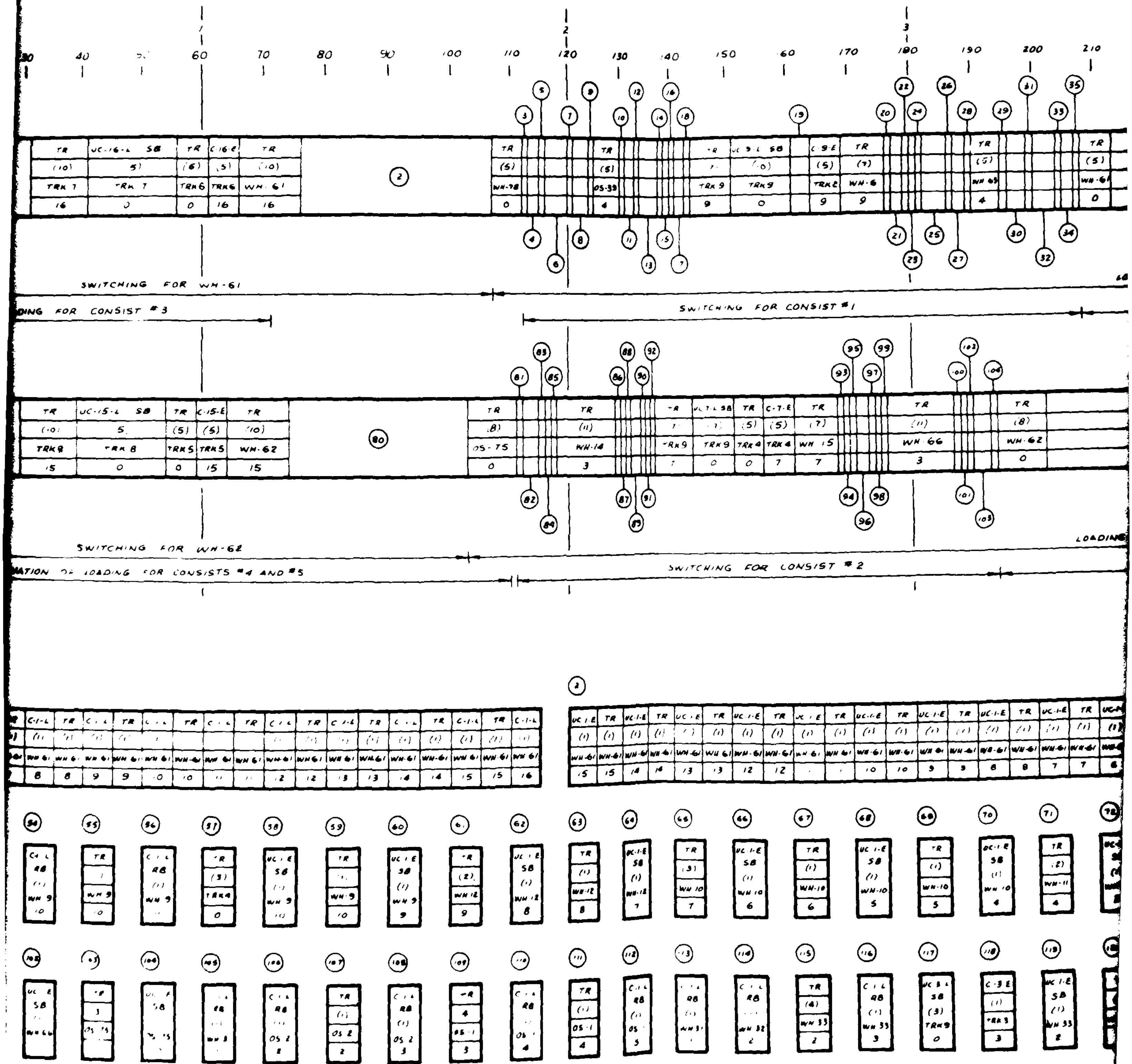


Figure 21. Rail o

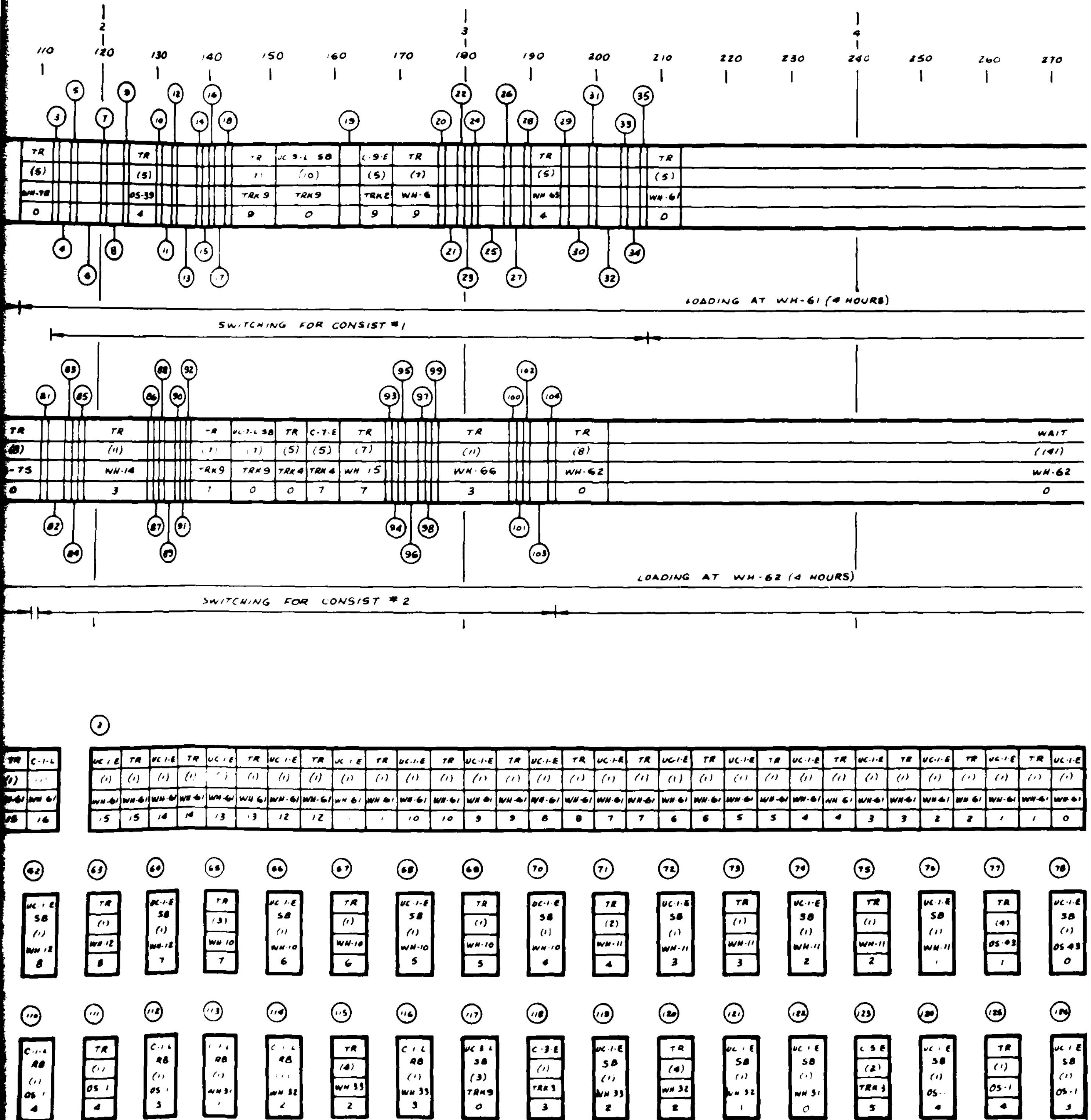


Figure 21. Rail outloading simulation.

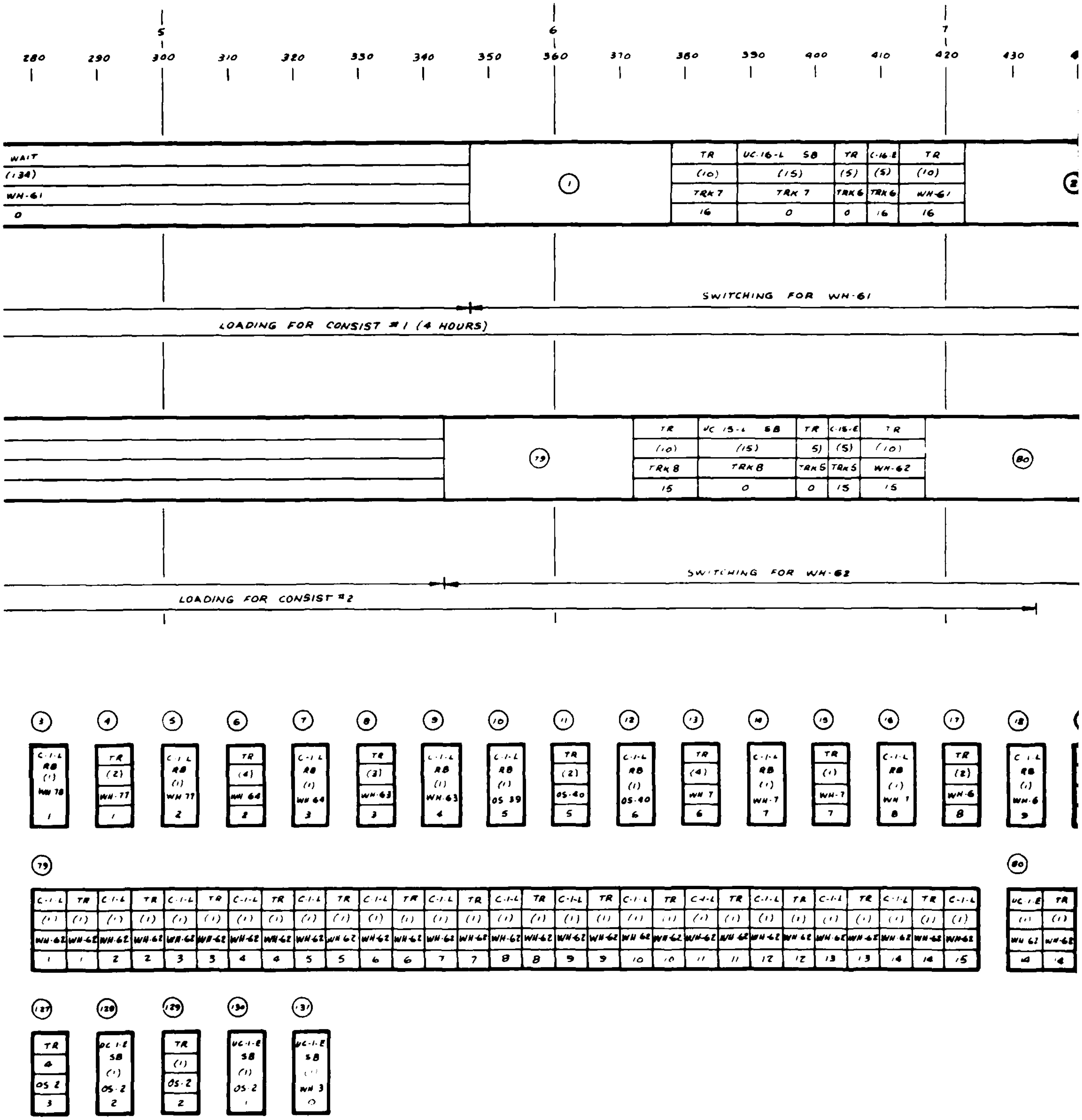
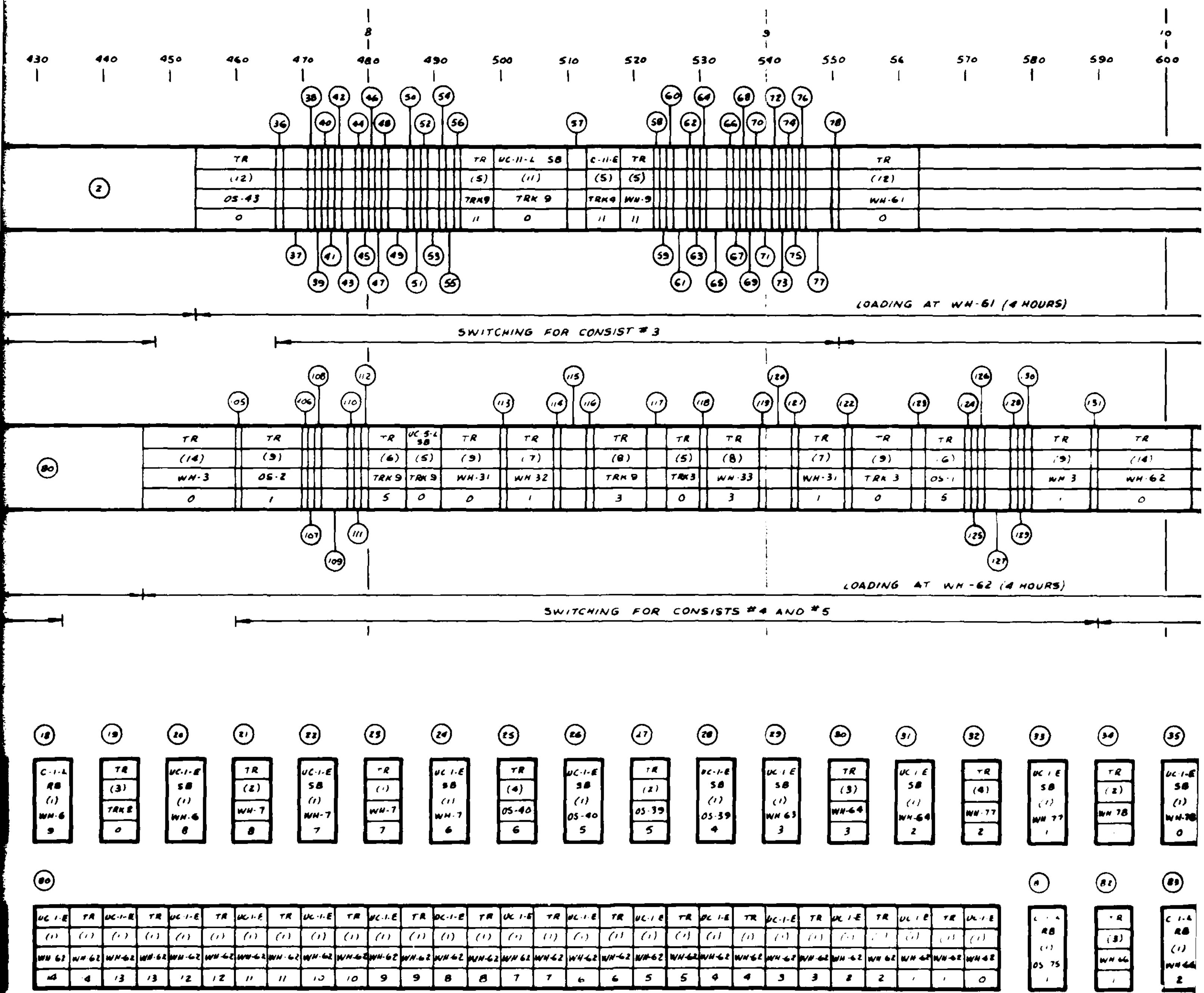
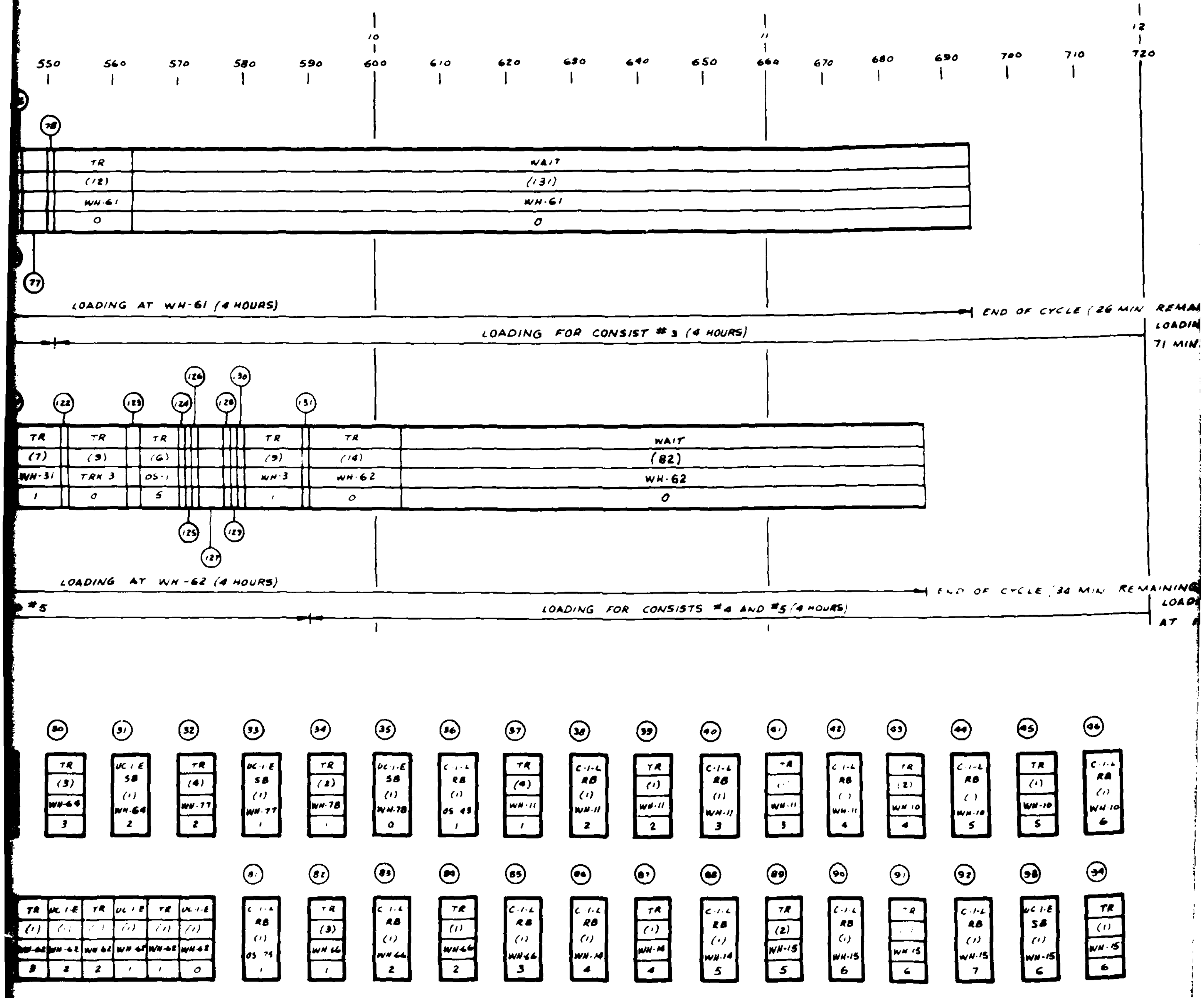


Figure 21. Continued.

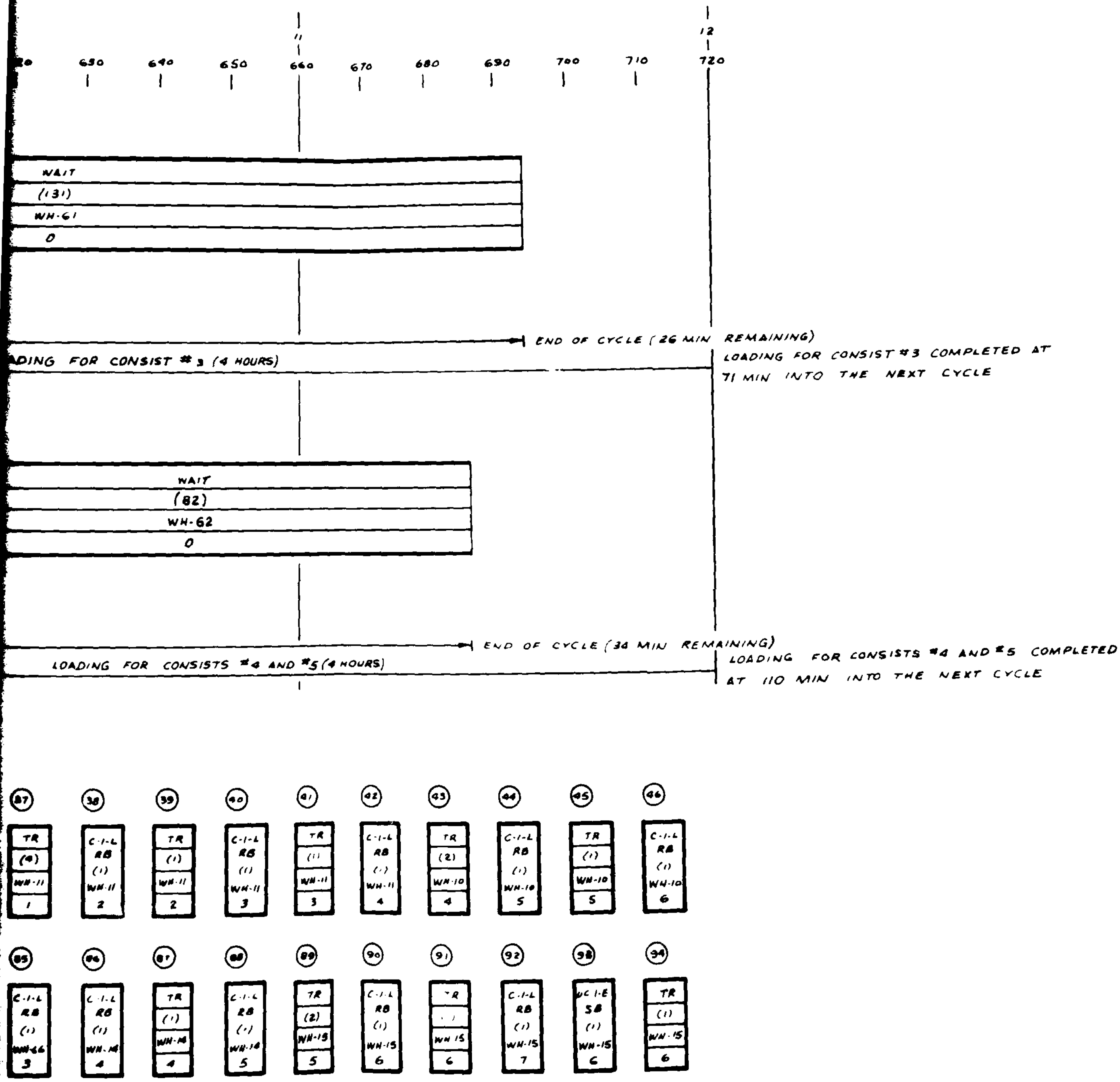


430 440 450 460 470 480 490 500 510 520 530 540 550 56 570 580 590 600
8
9
10
LOADING AT WH-61 (4 HOURS)
SWITCHING FOR CONSIST #3
LOADING AT WH-62 (4 HOURS)
SWITCHING FOR CONSISTS #4 AND #5

2


10
11
12
550 560 570 580 590 600 610 620 630 640 650 660 670 680 690 700 710 720
TR (12) WH-61 0
WAIT (131) WH-61 0
LOADING AT WH-61 (4 HOURS)
END OF CYCLE (26 MIN
LOADING FOR CONSIST #3 (4 HOURS)
71 MIN
TR (7) WH-31 1
TR (9) TRK 3 0
TR (6) OS-1 5
TR (9) WH-3 1
TR (14) WH-62 0
WAIT (82) WH-62 0
LOADING AT WH-62 (4 HOURS)
END OF CYCLE (34 MIN REMAINING
#5
LOADING FOR CONSISTS #4 AND #5 (4 HOURS)
AT

3



11
12
630
640
650
660
670
680
690
700
710
720
WAIT
(131)
WH-61
0
END OF CYCLE (26 MIN REMAINING)
DING FOR CONSIST # 3 (4 HOURS)
LOADING FOR CONSIST # 3 COMPLETED AT 71 MIN INTO THE NEXT CYCLE
WAIT
(82)
WH-62
0
END OF CYCLE (34 MIN REMAINING)
LOADING FOR CONSISTS # 4 AND # 5 (4 HOURS)
LOADING FOR CONSISTS # 4 AND # 5 COMPLETED AT 110 MIN INTO THE NEXT CYCLE
37
38
39
40
41
42
43
44
45
46
TR
C-1-L
RB
WH-11
WH-10
85
86
87
88
89
90
91
92
93
94
SB
WH-14
WH-15

3

1 4

The switching locomotive now transits to WH-61 and waits 134 minutes for the completion of loading of the cars at WH-61. At 347 minutes into the cycle, the switching locomotive begins coupling the loaded cars at WH-61 and, at 378 minutes into the cycle, transits to track 7 with these 16 loaded cars. At track 7, the 16 loaded cars are uncoupled and the locomotive transits to track 6 and picks up 16 empties. These empties are then dropped off at WH-61, spotting a car at each door. A total of 454 minutes has elapsed.

The loading at WH-61 can begin. The locomotive now transits to OS-43 to begin the switching for consist #3 and picks up loaded cars at the following locations: one at OS-43, three at WH-11, three at WH-10, two at WH-12, and two at WH-9. A total of 494 minutes has now elapsed.

The locomotive now transits to track 9 and uncouples 11 loaded cars, then transits to track 4 and couples 11 empties. These cars are now dropped off in reverse sequence to that in which they were picked up. The last empty car is dropped off at OS-43, with 551 minutes elapsed in the cycle.

The loading for consist #3 can begin. Note that less than 4 hours remain in the cycle. The loading for consist #3 is not completed until 71 minutes into the next cycle. However, this does not pose a problem since the switching for consist #3 does not occur until 466 minutes into the next cycle. The switching locomotive transits to WH-61 and waits 131 minutes for the completion of loading at WH-61, which occurs at 694 minutes into the cycle. The cycle is complete with 26 minutes remaining.

Switching Locomotive #2

Switching locomotive #2 has been going through a similar switching sequence at the same time as switching locomotive #1. To avoid redundancy, the following description is not as detailed as the one for switching locomotive #1. At the beginning of the cycle, switching locomotive #2 performs the switching for WH-62 and this is finished at 103 minutes elapsed time. Then the switching begins for consist #2 for the following locations: one car at OS-75 and two cars each at WH-66, WH-14, and WH-15. Switching for consist #2 is finished at 194 minutes into the cycle.

Now the locomotive transits to WH-62 and waits for 141 minutes until the completion of loading at WH-62. Switching begins again at WH-62 at 343 minutes into the cycle and is finished at 446.

The locomotive now transits to WH-3 and begins switching for consists #4 and #5 at 460 minutes into the cycle. Consist #4 is at the following locations: one car at WH-3, two cars at OS-2, and two cars at OS-1.

Consist #5 is at the following locations: one car each at WH-31, WH-32, and WH-33. The switching for consists #4 and #5 is finished at 590 minutes into the cycle.

The locomotive then transits to WH-62 and waits for 82 minutes until the completion of loading at WH-67. The cycle is now finished for switching locomotive #2 with 34 minutes remaining.

Reiterating, during each 12-hour cycle, switching locomotive #1 switches consists #1 and #3 once and WH-61 twice; also, switching locomotive #2 switches consists #2, #4, and #5 once and WH-62 twice. This gives an output of 97 railcars per cycle (12 hours), and a total output of 194 railcars per day (24 hours). The times required for various railcar switching operations are shown in table 6.

TABLE 6
TIMES REQUIRED FOR VARIOUS RAILCAR SWITCHING OPERATIONS AND LOCOMOTIVE CAPABILITY

C = Couple
UC = Uncouple
E = Empty
L = Loaded
SB = Set Brakes
Set brakes if cars are to be left overnight or loaded or on a steep grade.
RB = Release Brakes
UC-15-E(SB) = Uncouple 15 empty railcars, set brakes.

Empty

C-15-E (5 min)
C-30-E (10 min)
C-45-E (15 min)
UC-15-E (1-2 min)
UC-15-E (SB) (15 min)
UC-30-E (SB) (30 min)

Loaded

C-15-L (5 min)
C-30-L (10 min)
C-45-L (15 min)
But if cars have been sitting overnight brakes must be checked
C-15-L (RB) (15 min)
C-30-L (RB) (30 min) (or 15 min for 2 men)
C-45-L (RB) (45 min) (or 15 min for 3 men)
UC-15-L (1-2 min)
UC-15-L (SB) (15 min)
UC-30-L (SB) (30 min)

Note:
Above times are for daylight operations; add 5 minutes for night operations if brakes have to be set or checked.

TRANSIT SPEED

Average for all switching operations, 5 miles per hour. Engine with no railcars, 10 miles per hour for distances of one-half mile or more (except for nighttime; then add 5 minutes for each transit).

LOCOMOTIVE CAPABILITY

120-ton locomotive--1200 tons on 2.5% grade
Empties--34 cars
Loaded--24 cars
2 M-60 tanks on series 38 car, 9 cars per locomotive
16 cars per locomotive with 1 tank per car
2 locomotives--2 times above capabilities

Speed vs Time

@5 miles per hour = .00227 min/ft
@10 miles per hour = .00114 min/ft
@26 miles per hour = .000438 min/ft

APPENDIX C

SPECIAL-PURPOSE RAILCARS AND LOADING/UNLOADING PROCEDURES

Specially designed railcars, in particular those used for transporting vehicles, can greatly increase the speed and efficiency of a rail outloading operation. Bilevel, trilevel, and integral chain tiedown flatcars are the primary means of enhancing the loadout routine of most military vehicles. Bilevel and trilevel railcars are best suited for the smaller vehicles, including 2-1/2-ton trucks.

The integral tiedown flatcars will accommodate larger vehicles, including tanks. Loading and securing equipment on these railcars can be accelerated to 15 minutes per vehicle, for small vehicles, versus approximately 45 minutes for blocking and bracing procedures used on standard-type railcars. Also, the BTTX 89-foot flatcar has a capacity of six 2-1/2-ton trucks, doubling the single level capacity. Thus, in speed and capacity, special-purpose railcars are an advantage worth investigating.

There are essentially five methods of loading/unloading multilevel railcars, they are:

1. The "K" loader of 463L aircraft cargo-loading system.

2. The forklift and pallet used in conjunction with a crane and/or ramp.

3. The crane and ramp combination.

4. Adjustable ramps.

5. Adjustable built-in ramp on multilevel railcars.

The procedures used with each of the above are described in detail in TM 55-625[2/], as are tiedown procedures.

As of 1970, more than 70 percent of DOD installations had no organic capability to load/unload multilevel railcars. No outloading plans should include the use of these railcars until a thorough investigation verifies

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[2/] TM 55-625, Transportability Criteria and Guidanee, Loading and Unloading Multilevel Railcars at Military Installations in the United States.

their availability at the time required. The supply of special-purpose flatcars with integral tiedowns is also limited. As a result, even though these types of railcars are very valuable for volume rail outloading operations, their availability is seriously in question unless advance preparations are made.

The following trends in flatcar supply are now operative and have been since the development of modern piggyback service in the mid-1950's:

1. The size of the flatcar fleet has been growing, both in number of flatcars and in relation to the size of the car fleet as a whole. This gain has been confined to specialized cars; for example, trailer-on-flatcar, container-on-flatcar, bilevel, trilevel, and bulkhead flatcars.

2. The size of the general-purpose flatcar fleet has decreased, though average length and capacity have increased.

3. A majority of all flatcars are owned by car companies, not by the railroads. Therefore, more flexibility in assignment, with improved utilization, has resulted. Fewer idle cars are available for short-notice use than would be if each railroad maintained an adequate supply for its own needs.

Considering these trends, the sizes of the various components of the specialized flatcar fleet, and the blocking and bracing requirements for the various types of equipment to be shipped by rail, it does not appear prudent to express an installation's needs and outloading plan using only general-purpose flats. The TOFC fleet, in particular, is now most likely large enough to fill military requirements (table 18). The COFC fleet also has expanded to the point that it could carry most of the military's container movements, especially since COFC cars are used almost exclusively for import/export movements, which likely would be greatly disrupted in a mobilization period.

Accordingly, vans or containers should be outloaded on TOFC cars. If the movement is to a port for ocean shipment by other than RORO vessel, the use of COFC cars should be considered. However, the availability of COFC cars in the quantity desired without disrupting civilian container movements is highly improbable.

Other cars in the specialized flatcar fleet generally are assigned to specific services or to a carpool for one shipper's exclusive use. Therefore, although these cars can save blocking and bracing and should be requested when they can be employed profitably in a specific move, the likelihood of obtaining the cars is too weak to base outloading requirement on their use

TABLE 7

TRAILER TRAIN COMPANY FLEET

Trailer Train Company ownership of selected car types as contained in the April 1976 Official Railway Equipment Register. Trailer Train owns in excess of 95 percent of total US ownership of TOFC, COFC, and autorack cars.

Type	Reporting Marks	Quantity
TOFC	*TTX	29,661
	TTAX	5,033 (see also COFC cars)
	GTTX	2,287
	LTTX	1,876
	XTTX	733
	Total	39,590

Each car has a capacity of two 40-foot (nominal length) trailers. Some can handle one 40-foot and one 45-foot trailer. The XTTX cars also have the capability of transporting three 28-foot trailers.

Type	Reporting Marks	Quantity
COFC	TTAX	5,033 (see also TOFC cars)
	TTCX	708
	Total	5,741

Each car can handle four 20-foot container equivalents. Note that the TTAX cars can handle either containers or trailers and so are counted in both TOFC and COFC totals.

Type	Reporting Marks	Quantity
Bilevels	TTBX	4,333
	BTTX	2,776
	Total	7,109
Trilevels	TTKX	6,133
	RTTX	3,500
	KTTX	2,685
	TTRX	2,196
	ETTX	796
	Total	15,310

*Definitions of Trailer Train Company reporting marks (all are flatcars)

TTX - Equipped with hitches and bridge plates for the transportation of trailers.
TTAX - Equipped with movable foldaway container pedestals, knockdown hitches and bridge plates for transporting trailers or containers or combinations of both. (A = all).
GTTX - Equipped with hitches and bridge plates for the transportation of trailers built by General American Transportation Corporation. (G = general)
LTTX - Low deck (2' 8" or 2' 9" instead of 3' 6"), equipped with hitches and bridge plates. (L = low)
XTTX - Equipped with four hitches and bridge plates for the transportation of two trailers; one 45-foot and one 40-foot or three 28-foot trailers.
TTCX - Equipped with movable foldaway container pedestals for transporting containers. (C = container)
BTTX - Equipped with bilevel autoracks furnished by member railroads. (B = bilevel)
TTBX - Length 89' 4" or over, equipped with bilevel autoracks furnished by member railroads. (B = bilevel)
TTKX - Length 89' 4" or over, equipped with hinged-end trilevel autoracks furnished by member railroads.
RTTX - Length 89' 4" or over, equipped with fixed trilevel autoracks furnished by member railroads.
KTTX - Equipped with hinged-end trilevel autoracks furnished by member railroads.
TTRX - Equipped with fixed trilevel autoracks furnished by member railroads.
ETTX - Equipped with fully enclosed trilevel autoracks furnished by member railroads. (E = enclosed).

Factors affecting the use of specialized flatcars include:

1. First priority for use of general-purpose flats should be to load tracked vehicles and nonstandard wheeled vehicles; for example, artillery.

2. First priority for requesting specialized flats should be for TOFC and COFC cars to load vans and containers, which require very extensive blocking and bracing to move on general-purpose cars.

3. TOFC and COFC cars require no blocking and bracing.

4. Bilevel and trilevel flats will require heavier chains and possibly different hooks to handle other than commercial specification vehicles.

5. Chain tiedown flats may require heavier chains, depending on the loads for which they were designed.

6. Where TOFC cars must be loaded using a ramp rather than side or overhead loading, the number of cars at a ramp should be limited to about 10 because of the delay involved in backing the trailers down the length of the cars and returning with the tractor.

7. Where sufficient suitable aprons and MHE are available, it may be desirable to load containers directly onto COFC cars rather than to place them on bogies and use TOFC cars.

8. If COFC or TOFC cars are not available, some blocking and bracing time and expense can be saved by using bulkhead flatcars to carry containers.

9. Bilevel and trilevel cars require, obviously, bilevel and trilevel ramps or other equipment as indicated in TM 55-625.

10. TOFC, COFC, bilevel, and trilevel cars average 89 feet long. TOFC cars can handle two 40-foot trailers or one 40-foot and one 45-foot trailer. COFC cars can handle four 20-foot container equivalents. Autorack cars can accommodate four to seven vehicles per deck, depending on vehicle length and the number of tiedown chain sets.

11. Tracks used to store or load cars over 65 feet long should be reachable without going through curves exceeding 10-degree curvature, and tracks used for cars between 55 and 65 feet should be reachable without going through curves exceeding 12-degree curvature.

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